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IBM's Notebook Is to Die For

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The Best Sites For Finding or Filling Any Job

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Print Programs Make Projects Fun and Easy

The Virus Crisis:
Melissa Is Only The Beginning

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- Sneak Preview: nVidia RIVA TNT2
- Epson Stylus Photo 750
- HP PhotoSmart S20
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THE INDEPENDENT GUIDE TO PERSONAL COMPUTING AND THE INTERNET
VOL.18 NO.10 MAY 25, 1999

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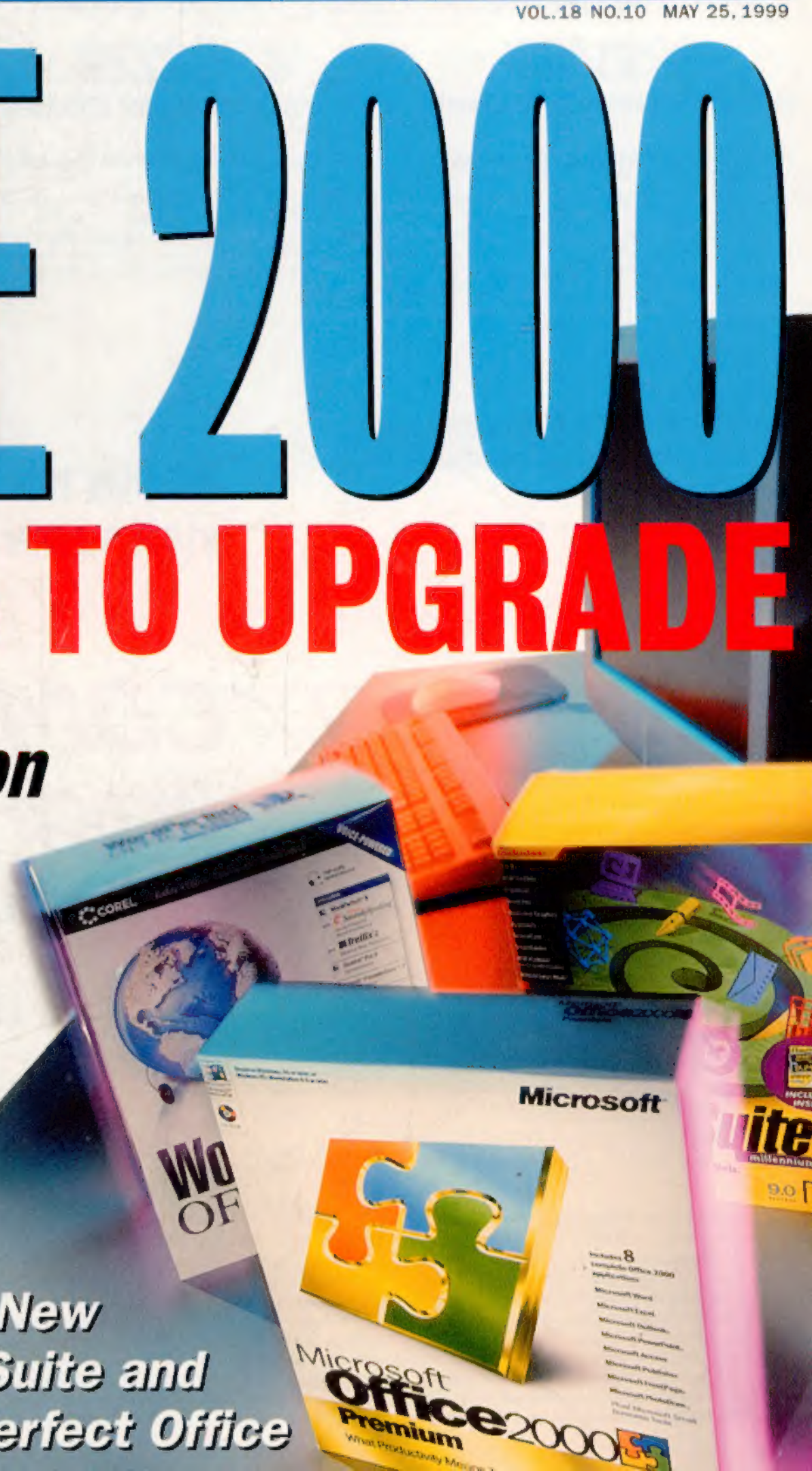

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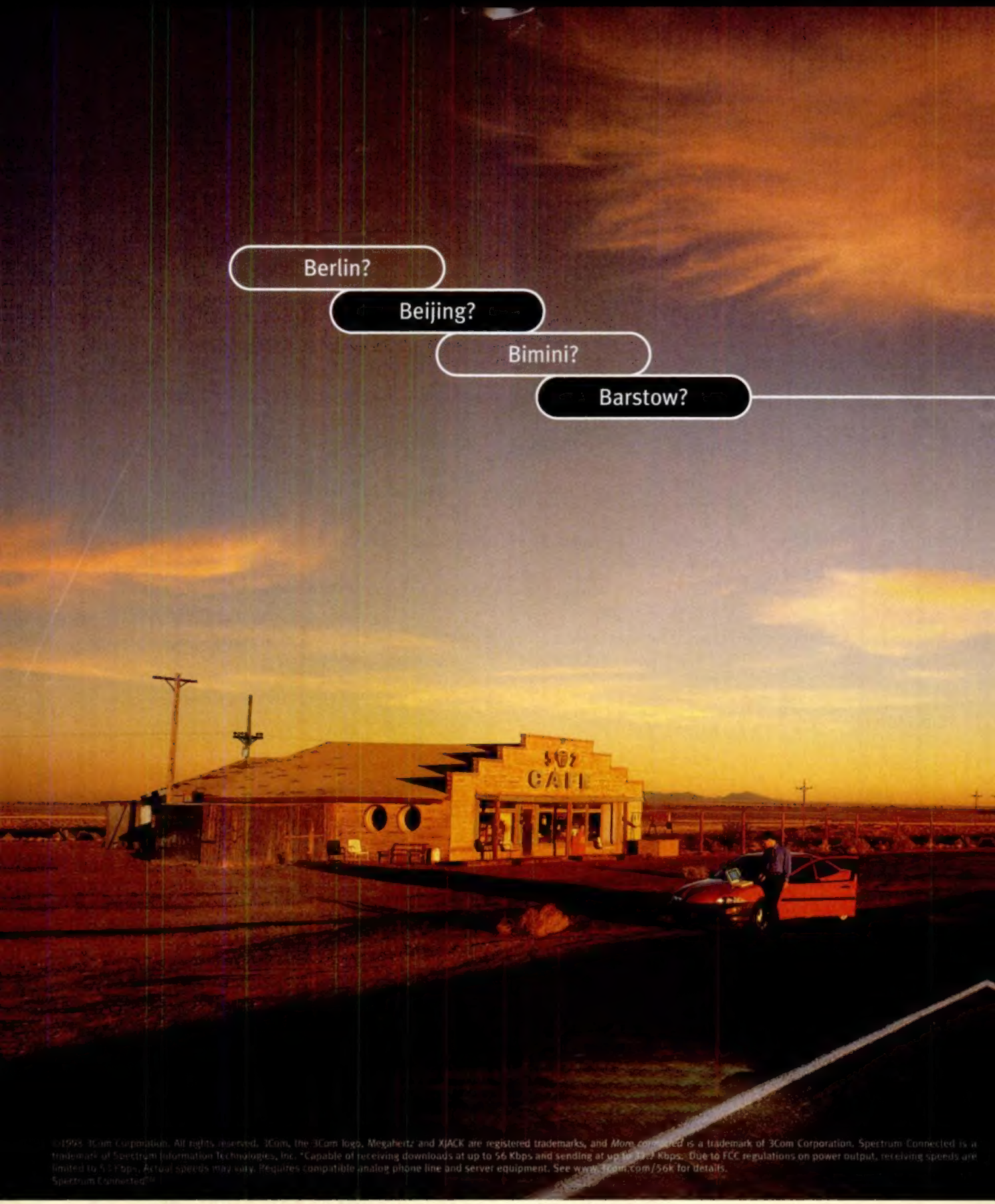

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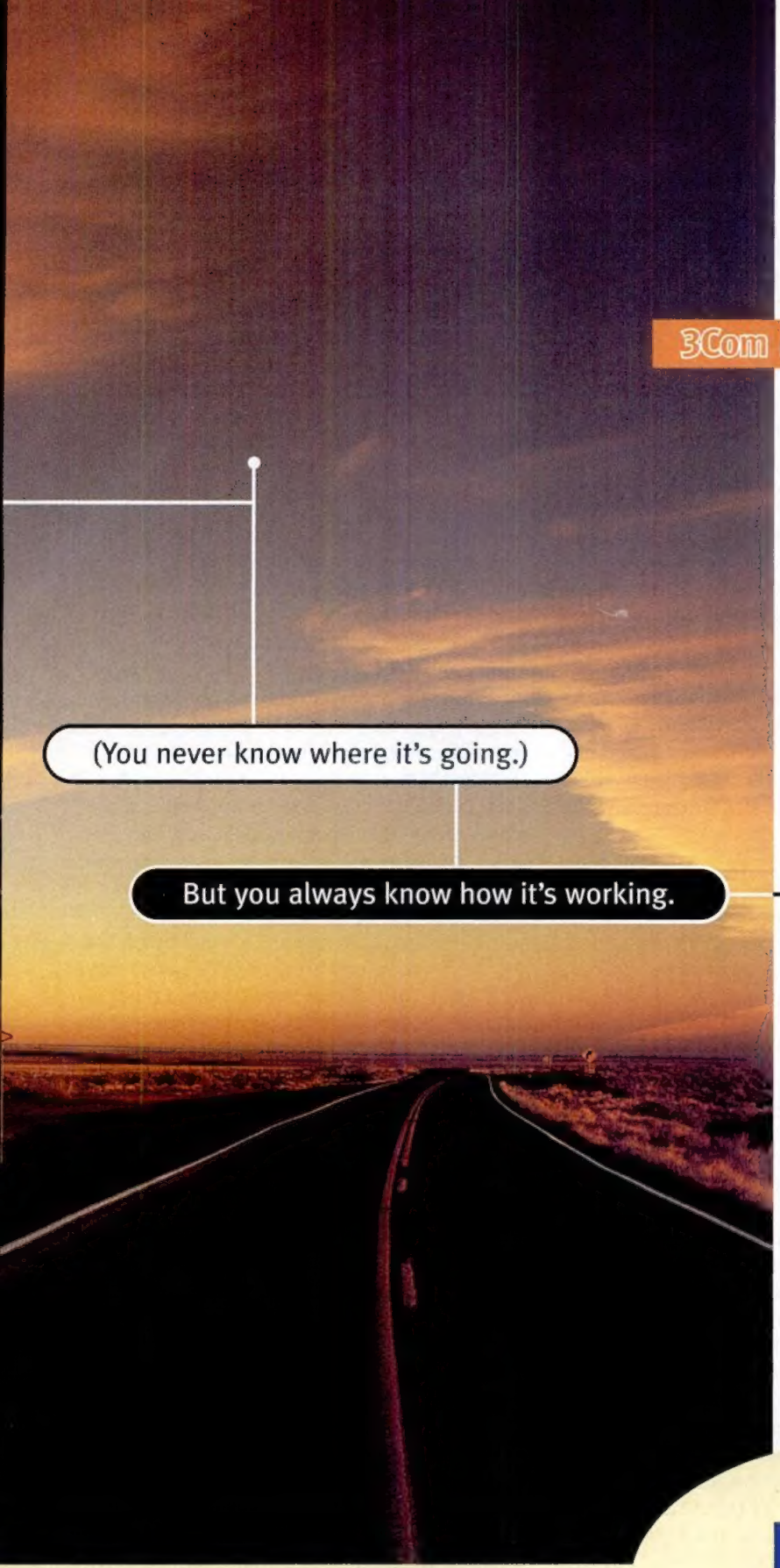

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Michael J. Miller

Not So Sweet Melissa

Like many of you, I was hit by the Melissa virus a few weeks ago. I received the infamous e-mail from someone I know, and I opened the attachment. It was a Microsoft Word document that contained a list of pornographic Web sites. I didn't understand why I had been sent this spam, but I ignored it. Of course, Melissa was built into the file as an embedded macro, and thus my system obtained the virus.

If you did what I did and you use Microsoft Outlook as your e-mail client, this embedded macro will send the document to the first 50 e-mail addresses in your Outlook address book. Then the virus attaches itself onto all subsequent new Word documents. If you then create and send a new Word document via e-mail and the recipient uses Outlook, that new document—perhaps a confidential company memo—when opened may be passed to the first 50 addresses listed in the recipient's address book.

By now, most of us know to be cautious about opening documents from unknown sources. But Melissa arrives on your machine from a trusted source—someone you know well enough to be in his or her address book. That's how the virus spreads.

The good news is that I wasn't really impacted by Melissa; most of us at Ziff-Davis use Lotus Notes for e-mail. Luckily, it didn't affect our corporate mail system. And thanks to the folks at ZD Network News, I found out about the virus a few hours after I unknowingly received it.

The bad news is that my system was infected with the virus, despite my having updated my antivirus program earlier that same day, just by chance. I ran Norton AntiVirus's Live Update about an hour before I got the virus; Symantec didn't post an update until several hours later. But don't fault Symantec: It and the other antivirus makers reacted very quickly. This just reminds us that no program can provide complete protection all the time.

The worse news is that I doubt Melissa was the last—or even the worst—of these attacks. In the days following the first Melissa attack, a number of copycat viruses appeared, such as "Papa," which affected Microsoft Excel.

Given all the publicity surrounding Melissa, I'm afraid that the irresponsible programmers who write viruses will view this as just another challenge. Now that Melissa is in the hands of all sorts of people, another virus writer can easily look at how it was written and make changes.

The biggest problem is that the architecture of Word and Excel, with their embedded macro capabilities, makes them great targets for virus writers. Visual Basic for Applications makes writing such macros easy, and in this context, that's the absolute worst news.

Macro viruses are now by far the most common kind of virus I see; everyone who uses Word and Excel is at risk. But I'm not convinced that the answer is a unique traceable number in every document, which apparently is how the Melissa author was caught.

Microsoft Word and Excel's architecture makes them great targets for virus writers.

One solution is to keep the macros in a separate file as WordPerfect does, but for Microsoft Office users this is probably too drastic an overhaul. Microsoft will address this threat in Office 2000 by making it easier for antivirus software to mesh with the suite. Also in Office 2000, macro authors will be able to sign their work digitally so you can identify who created a macro.

In the meantime, what can you do? Run an antivirus program. We reviewed several good ones in our previous issue. Make sure to turn on real-time protection and to update your virus definitions frequently. Disable macros unless you really need to run them for your business, or at least know who is sending them to you. Also, encourage your IT departments to install antivirus software on your e-mail and other servers. The potential cost of a widespread virus incident is too great to ignore.

Above all, be wary.

Fortunately (not to downplay things), all Melissa did was forward the mail, which can overload servers and potentially distribute confidential information without your knowledge.

Unfortunately, the next big virus could be a lot more destructive. PC

PHOTOGRAPHY BY JAY REED

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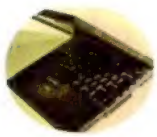

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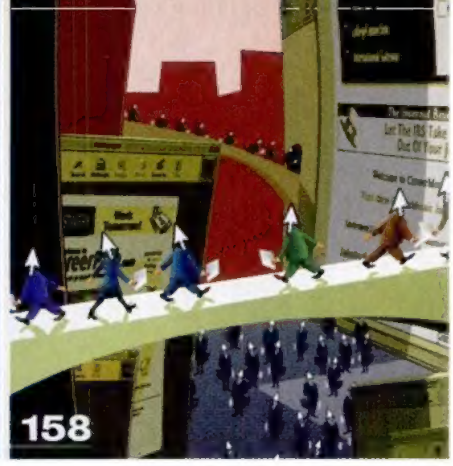

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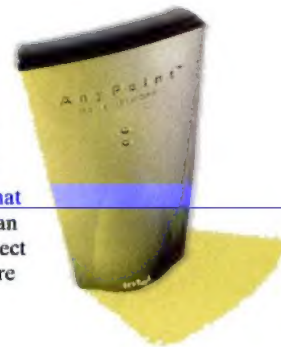

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The Wrath of Melissa

Corporate America may have been taken by surprise when the Melissa virus hit computers throughout the world over the span of a few days in March, but some antivirus researchers were not a bit surprised. "We've been expecting this for some time," says Steve White, senior manager of antivirus research at IBM's T.J. Watson Research Center, referring to the speed and manner in which Melissa infected systems and brought down corporate mail servers. "It spread much more rapidly than any previous virus in history."

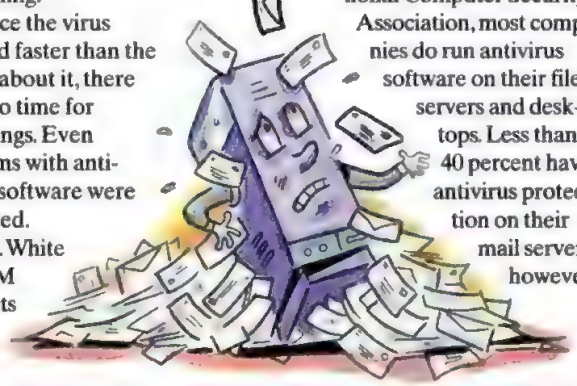
The Melissa virus was different than other virus attacks in the speed at which it spread, mailing itself to the first 50 e-mail addresses listed in Microsoft Outlook address books on infected systems. The result was perhaps history's largest mass e-mailing.

Since the virus spread faster than the news about it, there was no time for warnings. Even systems with antivirus software were infected.

Mr. White of IBM expects copycat viruses to follow in Melissa's footsteps, perhaps altering its payload—an attached file and a reference to "The Simpsons" deposited in Microsoft Word files. "We'll see this again and again," he says. And the prospect of viruses spreading around the world within hours, with the help of the Internet, isn't so far out. In fact, Papa—a copycat virus—did appear just days after Melissa.

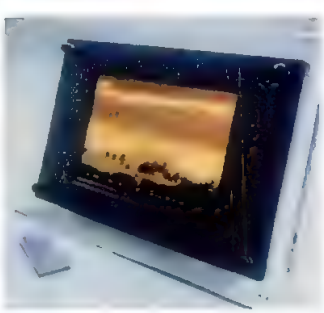
This threat is posing a new challenge for developers of antivirus software. In a virus epidemic such as Melissa, it's critical to disseminate the cure faster than the virus spreads. IBM and Symantec are collaborating on a digital immune system, which detects viruses, concocts cures, and distributes them around the world in under an hour.

"The Internet is relatively safe, if you make yourself safe," says Mr. White. According to the International Computer Security Association, most companies do run antivirus software on their file servers and desktops. Less than 40 percent have antivirus protection on their mail servers, however.



A $999 Picture Frame

The new Sony Digital Photo Frame is a 5.5-inch digital display that showcases full-motion video or a slide show of still images stored on a Sony Memory Stick. Wave your hand and a touchless sensor turns on the Digital Photo Frame. A timer turns it off automatically. The frame will be available in May for $999.

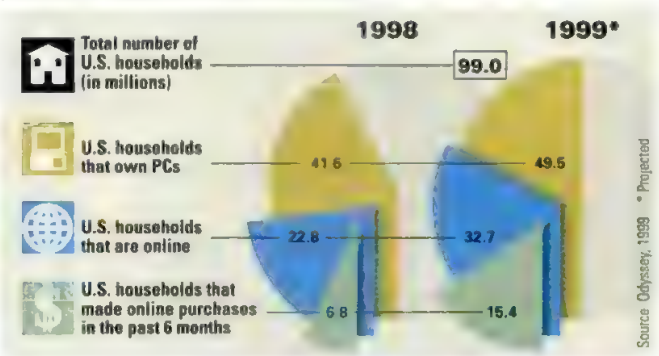


ILLUSTRATIONS BY M.E. COHEN (LEFT), MARK MATCHO (RIGHT)

35% *of respondents to a recent PC Magazine Online poll told us that they have already traded stocks online. Another 38 percent said that they haven't tried it yet but expect to in the future, but 27 percent said that they have no intention of trading online.*

The Untapped Web

Although it may seem as if the entire globe has already embraced the Internet, the numbers tell a different story. In the U.S. alone, 83 percent of households have never purchased anything online, according to a recent survey from market research firm Odyssey. And online banking hasn't caught on as expected: Only 9 percent of U.S. households use their PCs for banking, purchasing stocks, or accessing personal financial information online.



With 50 percent of U.S. households owning a PC and 33 percent subscribing to online services, the pool of untapped consumers is still vast, and growth figures are rosy. Of those households that are online, 47 percent made online purchases within the six months prior to the January survey, up from 30 percent in the previous survey. PC households also increased the number of hours they spent using PCs for entertainment by 23 percent to 4.9 hours per week, up from 4 hours per week during the previous six months.

Your Printer's Web Address

Who needs fax machines? The Printer Working Group, a consortium of printer manufacturers, is pushing a new Internet protocol designed to let Web users send files and messages directly to a remote printer. If the Internet Engineering Task Force approves the protocol, you may be sending files and messages directly from the World Wide Web to someone else's printer as the year 2000 arrives.

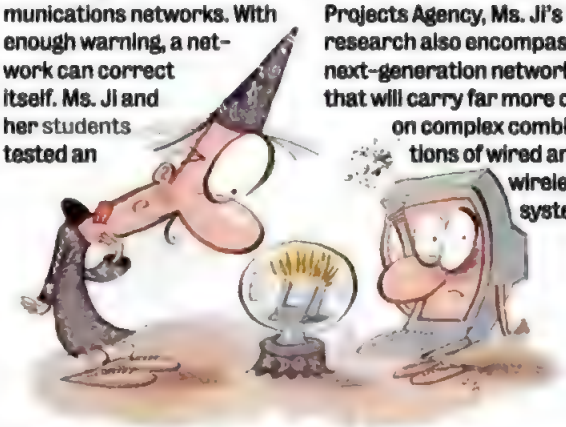
The Internet Printing Protocol (IPP) is a client/server standard that can interrogate the capabilities and state of a printer and let an Internet user submit a print job, after which IPP software monitors the state of the job. You'll also be able to glean information about a remote printer's functionality, such as acceptable paper sizes and color capabilities.

Predicting Failures Successfully

Seeing a truck about to pull in front of you in time to step on your brakes is an annoyance. Getting the information seconds later can be a disaster.

Chuanyi Ji, associate professor of electrical, computer, and systems engineering at Rensselaer, builds intelligent agents designed to warn of impending failures on communications networks. With enough warning, a network can correct itself. Ms. Ji and her students tested an agent on a router on a local area network and found that it successfully predicted some faults before they occurred. In one case, the agent predicted a failure—caused by a buildup of abnormally high traffic—minutes in advance.

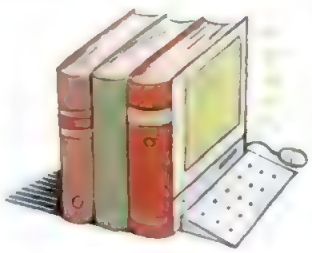
Funded by the National Science Foundation and the Defense Advanced Research Projects Agency, Ms. Ji's research also encompasses next-generation networks that will carry far more data on complex combinations of wired and wireless systems.



Web Reading Room

Content being posted and pirated on the Internet petrifies book publishers, so it's understandable that they haven't embraced the idea of online distribution of electronic copies of books.

NetLibrary has come up with a system it hopes will pave the way for publishers to post their books online safely. It has invested in digitizing works from publishers—mostly university presses—for free, which it then sells over the Web. Its distribution model offers several protections for intellectual property. If you lend out a book, your machine's copy will be disabled. If you try printing more than a few pages, you'll be thrown out of the library. And if you cut and paste material to a Word document, a footnote will be added automatically.



Geared for the learning market—an $11 billion slice of the $25 billion book market—NetLibrary has also opened a reading room on the Web that stocks all its titles. A $100 annual membership lets you check out any book in the library to read online or download and read with NetLibrary's viewer.

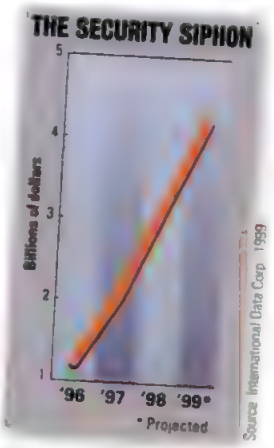
ILLUSTRATIONS BY HAL MAYFORTH (TOP), DAVE KLUG (BOTTOM)

THIS ISSUE'S CONTRIBUTORS: *Carol Levin, Sharon Nash, Sebastian Rupley, Don Willmott.*

Ghosts in the Machines

When the Melissa e-mail virus hit recently, the spotlight was cast on data security. In a recent survey from market researchers at IDC, IT executives said that data security risks are growing almost as fast as the Internet.

IDC found that the worldwide Internet security software market grew 67 percent in one year, from 1996 revenues of $1.2 billion to 1997 sales of $2.0 billion, and that revenues continued to grow to an estimated $3.1 billion in 1998. Moreover, IDC expects the market to reach $4.2 billion in 1999 and $7.4 billion by 2002. Antivirus software will be the largest security software market by 2002, with revenues of $3 billion.



Top Web Shopping Sites

Visitors per month, in thousands

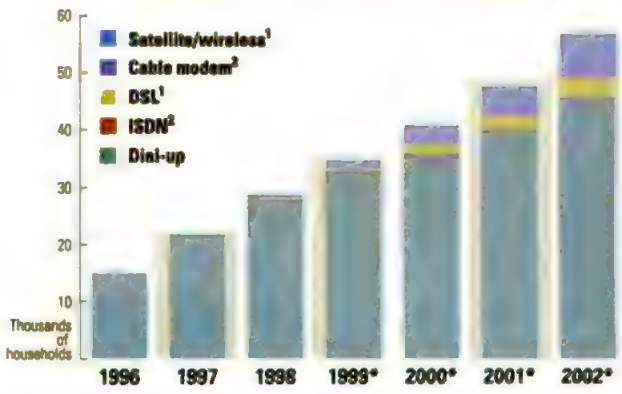
Source: Media Metrix, February 1999.

Instant Replay

Few technology races are as heated right now as the portal race. In an effort to differentiate itself, Compaq's AltaVista division has come up with a new multimedia search engine that can retrieve video, audio, and sound clips. Called the AV Photo & Media Finder, the search engine brings up still-frame snapshots of video hits and synopses of multimedia data found.

Fast Internet for a Few

By 2002, only 20 percent of U.S. households will access the Internet via broadband connections, says market research firm Jupiter Communications. Of the high-speed connections cable modem will outpace DSL.



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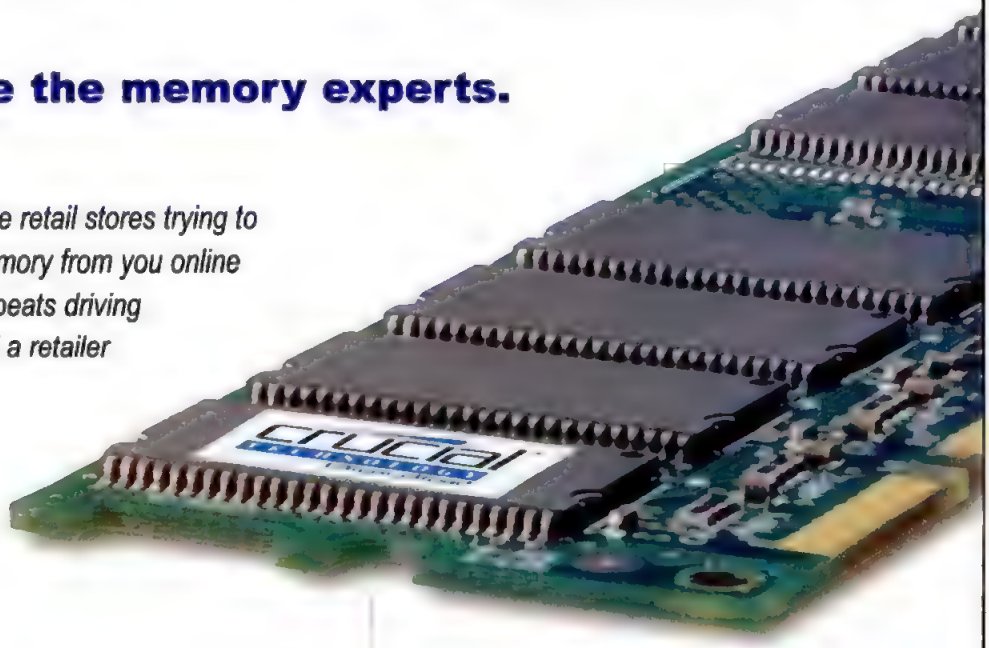

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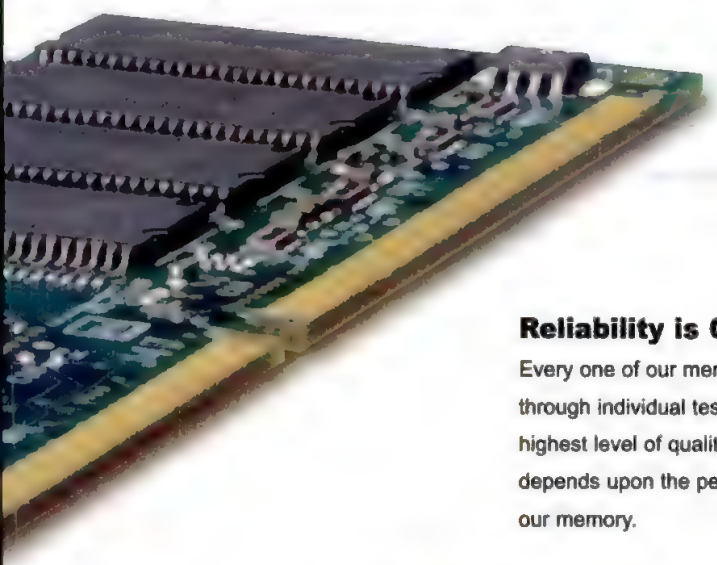

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Intel Pentium II Processor, 300 MHz	Intel Pentium II Processor, 366 MHz	Intel Pentium II Processor, 333 MHz	Intel Pentium II Processor, 300 MHz
13.3" TFT Active Matrix XGA Display	14.1" TFT Active Matrix XGA Display	14.1" TFT Active Matrix XGA Display	14.1" TFT Active Matrix XGA Display
64 MB SyncDRAM expandable to 192 MB	96 MB SyncDRAM expandable to 192 MB	64 MB SyncDRAM expandable to 192 MB	64 MB SyncDRAM expandable to 128 MB
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2nd-Generation DVD-ROM Drive[4]	24X Max CD-ROM Drive[3]	2nd-Generation DVD-ROM Drive[4]	24X Max CD-ROM Drive[3]
256-bit AGP Accelerated 3D Graphics w/2.5 MB VRAM	256-bit Accelerated 3D Graphics w/2.5 MB VRAM	256-bit Accelerated 3D Graphics w/2.5 MB VRAM	256-bit Accelerated 3D Graphics w/2.5 MB VRAM
56K ITU V.90 Modem[2]	56K ITU V.90 Modem[2]	56K ITU V.90 Modem[2]	56K ITU V.90 Modem[2]
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256 KB Integrated "On-chip" cache	256 KB Integrated "On-chip" cache	256 KB Integrated "On-chip" cache	256 KB Integrated "On-chip" cache
Folio Carrying Case	Microsoft Office 97 Small Business Edition	Microsoft Office 97 Small Business Edition	Microsoft Featured Home Collection
Microsoft Office 97 Small Business Edition*	Microsoft Windows98	Microsoft Windows98	Microsoft Windows98
Microsoft Windows98			
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Extra AC Adapter: Add $49	2nd-Generation DVD-ROM Drive:[4] Add $149	Port Replicator: Add $129	Extra AC Adapter: Add $49
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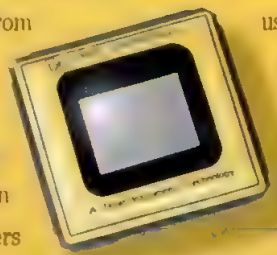

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TEXAS INSTRUMENTS

LETTERS

COUNTING DOWN TO Y2K

Your article "Y2K Countdown" (April 6) suggests that one of the most expensive results of Y2K will be litigation by consumers who are "ignorant" of the need for regular hardware and software upgrades. But the computer industry fails to understand that a consumer who buys hardware and software for a specific job in the 1990s does not expect the system to stop working merely because the date changes from 1999 to 2000.

As the person responsible for my office's small network, I tested all our computers and software for Y2K compliance last year and discovered that one essential piece of software (time-billing software, no less) was not Y2K-compliant. The software company's "fix" for this bug is to offer a new version of the program. The new version is unnecessarily complicated and ultimately is not as well suited to the task as the program we bought in 1993 and expected to keep using well into the next millennium. It is ridiculous to suggest that a company that designs timekeeping software could not, in 1993, have foreseen the potential for Y2K problems.

Most companies in the real world want to keep using software that works and which they have invested time and money to learn. They do not want to spend their earnings on constantly changing software and hardware. Nor do they want to waste time resolving the problems that inevitably result when employees have to learn to use new equipment and computer programs. Perhaps the Y2K bug is just a new version of built-in obsolescence.

TIM MIDGLEY
via the Internet

I just finished reading "Y2K Countdown." It still amazes me that with the obsession with Y2K, everyone has forgotten the other big problem. Every 11 years, our sun enters a state of extreme activity that plays real havoc with communication systems. The last time this happened, it disrupted the control systems for the power grid supplying Ontario, Canada, causing a massive power outage. Pagers, cell phones, GPS, satellite TV (both DSS and network feeds to your local station), point-of-sale credit and debit card processing, and so on, are all susceptible. The real one-two punch is that the next period of extreme solar activity is due at about the same time as Y2K hits. Armageddon? No. A real pain in the butt? Yes.

RICHARD DERRICK
via the Internet

YOUR OWN PRIVATE WEB SITE

The article "A Web Site of Your Own" (April 6) was very interesting. I appreciate that it was geared to novices at Web design, but I disagree with the inclusion of AOL Hometown. Yes, AOL does offer rich features for Web development, but as you mentioned in the article, it's free only to AOL members.

> Perhaps the Y2K bug is just a new version of built-in obsolescence.

I am looking forward to more eye-opening articles on free e-mail services, counters, guest books, and free list servers on the Net.

SHAMSUL AREFIN SHAIKH
Ames, Iowa

I read with interest your reviews of free Web site services. I was particularly interested in the review of GeoCities, as I'm a Community Leader at GeoCities (which means I'm a volunteer who helps homesteaders get their pages up and running and answers questions about GeoCities). I was dismayed that you didn't give GeoCities a better review. You state that there is no way to opt out of having the watermark appear. This is not true. Becoming a GeoPlus member, which also gives you an extra 14MB of Web space, makes the watermark disappear. Also, you don't mention that pop-up ads can be removed by putting a banner at the top of every page, called a GeoGuide. The GeoGuide allows a visitor to your page to leave you e-mail, sign your guest book, or look at pages like yours, among many other features. As for chat rooms and message boards, though GeoCities doesn't offer them directly, you can very easily find such items to use on your page for free. For example, I use a message board from Beseen.com.

DANA MARSHALL
via the Internet

GeoPlus is a fee service, and our reviews focused on free Web site–building services. Moreover, according to GeoCities, GeoPlus members are required to keep the watermark on their pages. The GeoGuide does remove pop-up ads, and you can certainly find elements elsewhere on the Web to use on your site at no charge.—Ed.

Xoom was underrated in your article. I agree that it does not offer many beginner templates, but it does offer more of a community for the intermediate user, and it has shorter URLs than any other service (*http://members.xoom.com/yourchoice*). One drawback that comes with its newly available unlimited space is a small advertising bar on top of every page, but I think that's an acceptable price. I believe Xoom is the place for intermediate users, and GeoCities is right for the beginner.

PETTER HOLLAND
via the Internet

One issue that the excellent review of free Web hosting sites did not cover was that at least some of the companies strip title or header information from a submitted page before posting. This makes it difficult or impossible for such pages to be listed sensibly by a search engine. It seems to me that making their hosted sites easier for browsers to find would be in the best interests of the hosting companies, as well as those seeking a place to put up their Web shingles, and that this information should be left intact.

MARTIN LABAR
via the Internet

NETWORKS BEGIN AT HOME

Regarding "Network Your Home" (April 6): I don't really care if the PC cognoscenti call network interface cards *NICs*, but it's profoundly irritating to be bombarded with such abbreviations without a glossary, particularly when acronyms like *10Base-T* (which we've all heard but which few can interpret) are explained only briefly. The folksy tone may be fireside-perfect, but this article left me unenlightened. You obviously did a lot of work, but you didn't make me aware of my options. Maybe you should be asking people like me what we want to know before you start.

JONATHAN CHRISTIE
Los Angeles, California

OVERPROTECTION

I sincerely hope Bill Howard is wrong about software vendors moving to processor ID–based protection schemes, should all future CPUs get unique ID numbers ("Scenes from the Industry," April 6). I bought Mathematica,

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SO WHAT IF WE'RE THE SMALL FISH IN THE BIG POND.

Piranha, pi-rän'ya, n. A small, voracious freshwater fish that will attack any sized opponent, no matter how large.

We're not the biggest, so we have to be the best.

So, we're not the biggest – that means we try harder...we have to be the best. By offering the perfect **combination of** service, quality and price, you get the best hardware solution possible. **Personalized Service:** You will be assigned a SAG Integration Specialist who will be your single point of contact from pre- to post-sale. It's their job to know your system inside and out. **100% True Customization:** Everybody claims to offer customized solutions, but our systems are truly built to order; you specify it, we build it. **Warranty & Support:** Our 3-year extensive warranty rivals the industry giants – plus you'll speak directly to our own on-staff tech advisors. **Leading Edge Technology:** We are known for being first-to-market with the latest technology. **Best Price:** Our prices continually beat our competition, see for yourself at sagelectronics.com. **Top Quality:** We only use top-of-the-line components. That's why we've won so many awards. Here are just a few:

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- 512KB Cache Expandable To 2 CPUs
- 256MB SDRAM Expandable to 2GB
- Slots: (6) PCI (1) ISA (1) AGP
- [illegible] 4MB Video Removable HD
- AMI LVD Ultra2 Raid 0-5 Controller
- ES Galaxy 32MB Dual Port Video
- Sony 32X CD-ROM, Max
- Keyboard Floppy Mouse
- Full Tower 300 Watt

5278

- 1, Intel Xeon PIII 500Mhz Processor
- 512KB Cache Expandable To 2 CPUs
- 128MB SDRAM Expandable to 2GB
- Slots: (6) PCI (1) ISA (1) AGP
- Sound & Ethernet 10/100 by Intel
- Matrox G400 32MB 4X AGP Video
- IBM 22GB 7200RPM IDE
- Sony 32X CD-ROM, Max
- Keyboard Floppy Mouse
- Full Tower 300 Watt

2779

- Intel Pentium II XEON 400Mhz
- 512KB Cache
- 64MB SDRAM Expandable to 2GB
- Slots: (5) PCI (2) ISA (1) AGP
- 10GB 5400RPM IDE Drive
- Sony CD Recorder Rewritable
- Matrox G200 16MB AGP Video
- Keyboard, Floppy Mouse
- Mid Tower Chassis

1700

- 1) Intel Pentium II 500Mhz Processor
- 512KB Cache Upgr To 2 CPUs
- 128MB SDRAM
- Slots: (5) PCI (2) ISA, (1) AGP 8X chipset
- IBM 10GB 7200RPM Ultra 33 Drive
- Sony DVD CD-ROM
- Soundblaster Live
- Subwoofer Speakers
- 16MB Diamond Viper 550 TNT Video
- Keyboard, Floppy Mouse
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2159

9GB Remov LVD 10,000RPM Solution [illegible]

- Celeron 433Mhz w/ 128KB Cache
- 32MB SDRAM
- Slots: 3/PCI (3)/ISA (1 shared) (1) AGP
- BX Chipset
- Integrated PCI Soundblaster
- 8MB nvidia Video
- 10GB IDE Hard Drive
- Sony 32X CD-ROM, Max
- Keyboard Floppy Mouse
- Intel Landesk Management Software
- Desktop Chassis

772

Celeron 433Mhz Solutions Available

[illegible] QUAD SERVER

- Intel Xeon PIII 500Mhz Processor
- 512MB Cache Expandable to 4 CPUs
- 256MB ECC Memory Expand to 4GB
- Slots: (7) PCI (1) ISA • Integrated 2MB Video
- Integrated Dual Ultra 2 LVD SCSI Controllers
- 3 Chan. Ultra 2 LVD RAID Cont. w/ 64MB Cache
- [illegible] 7200RPM Remov. HD
- Intel Server Adaptor
- Server Management System On-board
- 32X CDROM, Max • Keyboard Floppy
- 9 Drive Bay [illegible] 250 Watt Redundant Power Supplies

10,921 WEB CODE 5100

Rackmount Solutions Available

[illegible] RACKMOUNT PIII 450MHZ

- (1) Intel PIII 450Mhz Processor
- 512Kb Cache Expandable to 2 CPUs
- 128MB ECC Memory Expand to 2GB
- Slots: (5) PCI (1) ISA (1) AGP
- 8 MB AGP Video
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- Integrated Adaptec Ultra 2 LVD SCSI Controller
- 9GB [illegible] 7200RPM HD
- 32X CDROM, Max Keyboard Floppy
- 2U Rackmount 300 Watt Power Supply

2791 WEB CODE 5101

Tower Solutions Available

[illegible] 550MHZ RAID 5 SERVER

- (1) Intel Xeon PIII 550Mhz Processor
- 512Kb Cache Expandable to 2 CPUs
- 256MB ECC Memory, Expand to 2GB
- Slots: (6) PCI (1) ISA (1) AGP
- Matrox G200 8 MB AGP Video
- Integrated Intel 10/100 Ethernet
- 3 Channel LVD RAID 5 Contr. w/ 16MB Cache
- 3 9GB [illegible] 7200RPM 7.6ms Remov. HD
- 32X CDROM, Max Keyboard Floppy
- 13 Bay Tower Chassis 400 Watt Redund. Hot Swap Power

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3 Bay Rackmount Solution [illegible]

[illegible] DUAL PIII 500 10GB SERVER

- 1 Intel Pentium II 500Mhz Processor
- 512KB Cache Expandable to 2 CPUs
- 128MB ECC Memory Expandable to 1GB
- Slots: 4/32 Bit PCI (2) 64 Bit PCI, GX Chipset
- Dual PCI Buses, 66MHz PCI Support
- Integrated Adaptec Ultra2 LVD SCSI
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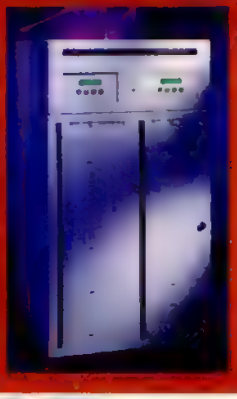

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- Redundant Power Supplies
- 16MB Cache

Internal Temperature Status

- Power Supply Status
- Cooling Fan Status
- Visual and Audible Alarm

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Q (3) 9GB 10,000RPM 5.0ms LVD HD 6458

STC 20 BAY

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- Q (2) 4 Channel RAID 5 U/W Controllers
- 8 230 Watt Hot Redundant Power Supplies
- 128MB of Cache

Internal Temperature Status

- Power Supply Status
- Cooling Fan Status
- Visual and Audible Alarm

72GB Solution

Q (8) 9.1GB 7200RPM LVD HD 18750

72GB Solution

Q (8) 9GB [illegible] 10,000RPM 5.0ms LVD HD 20,300

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LETTERS

from Wolfram Industries, a program so heavily copy-protected I had problems from day one. When I installed Windows NT Service Pack 4, I had to reinstall Mathematica; it simply stopped working. Now I fear that if my computer crashes, I'll have to contact the company yet again for another password, because even the backup copies don't work on any other machine. If software vendors ever move to widespread processor ID copy protection, consumers should start a revolt. Stop the insanity now.

RON HUBBARD
via the Internet

FIRE AWAY

Regarding your article "Fire Your Broker" (March 23): I was disheartened to find that you chose to go for the "low-hanging fruit"—sites with large advertising budgets that promote themselves heavily in off-line media. The true gems of the Internet are high-quality sites that are known by savvy Internet users but may not have the resources of large corporate entities. I expect a publication like *PC Magazine* to understand the enabling power of the Web for small entrepreneurs.

Case in point: One site you did not include in your list of mutual fund sites was Mutual Funds Interactive (*www.fundsinteractive.com*), a site that has been a favorite of business writers for nearly four years. Yet MFI does not advertise or engage in other publicity efforts; it has succeeded solely through the quality of its content and word of mouth.

ROB BRILL, PRESIDENT
BRILL INTERACTIVE
PUBLISHER OF MUTUAL FUNDS INTERACTIVE
via the Internet

I have been reading your magazine for about six months and am hooked. I really enjoyed the story about online brokers and financial firms. I have been a Motley Fool for quite a while, and I have not seen a detailed list of the services that online brokers offer. I believe that *PC Magazine* has the consumer's best interest in mind. I want to thank you for your timely and necessary article. The data you rounded up saved me a lot of time.

DANIEL CHAMBERS
via the Internet

WHERE'S THAT TUNE?

I recently read "Where Are the Good Tunes?" (Second Looks, April 6), about the problems many users experience finding MP3 online. While it may be true that simply going online hoping to click a couple links is a relatively fruitless process, it is not true that what you want is not out there. Most MP3 sites require you to upload files before you can download any, and therefore an FTP client is necessary: Simply right-clicking a link and saving will just spawn a confusing error message. Herein lies the Lycos MP3 search engine's problem: It lacks the FTP shortcuts necessary to download most music files. I suggest going to AudioGalaxy (*www.audiogalaxy.com*), a very comprehensive site that has all the information you need to start a great MP3 collection. The music is out there; you just have to know how to get it.

SPENCER BROWN
via the Internet

A FAMILIAR RING

In your Letters column (April 6) Russell Droullard of Irvine, California, wrote: "Furthermore, Microsoft will never trounce Adobe because of the installed base of Adobe software at the service bureaus and prepress houses around the world." Isn't that what everyone was saying about WordPerfect just a couple of years ago? WordPerfect market share was higher than 80 percent prior to Microsoft's introduction of Word. Now take a look at WordPerfect: It is on a clear path to becoming a has-been! I have always enjoyed using WordPerfect, and I find this situation very unfortunate. I believe Adobe still has a chance to turn things around, but it must move quickly, or it might become known as "Adobe who?"

DENNIS D. PEARSON
Waukegan, Illinois

INFORMATION, PLEASE

I was disappointed by your story on the new PIII computers—not by what was said but by what wasn't said ("Pentium III Hits 500," March 23). In some reviews, you made the point that the reviewed PC had no free IRQs or only one free IRQ. Are we then to suppose that all the other machines had at least two free IRQs? Why wasn't the number of free IRQs listed on the features table? You also made much of those systems that came with one month of free Internet access. Did you seriously think that these machines are going to be purchased by anyone who doesn't already have an Internet account? I can't see Granny buying a 500-MHz Pentium III as her very first computer.

The reviews said nothing about bundled software. This is something that can be worth hundreds of dollars to the purchaser. Bundled software will be one of the deciding factors when I buy my next computer. Yet at the same time you made sure to note which machines came with an Ethernet card—a $50 item. *PC Magazine* needs to get its priorities straight and concentrate more on what is important to readers and less on the "talking points" of the vendors' marketing departments.

TONY STELMACK
Choctaw, Oklahoma

OPEN FOR DISCUSSION

Let me start by saying that I am 100 percent in favor of open-source software ("Software Returns to Its Source," March 23). Nevertheless, as a C++ programmer, I have to add I was disappointed that you didn't give enough emphasis to development issues. While selling the idea of open-source software, you cannot say, "Developers can write quick patches that solve little problems." The process of developing and debugging new code is very time-consuming and not easy at all, especially if it is about someone else's code. Doing it right means digging deep into the code and understanding the design.

EREZ NASSIMI
Marlton, New Jersey

Corrections and Amplifications

In "Plastic Displays" (Pipeline, April 6), we incorrectly stated that "TFTs require 100 watts of voltage" and that use of the insulating material BZT "brought down the voltage to a manageable 5 watts." It should have read: "TFTs consume 100 watts of power" and "reduced the power consumption to a manageable 5 watts."

In "Two-Way Pagers That Beep and Browse" (Trends, April 6), we stated that Motorola's Productivity Software Suite costs $19.95 a month and that Motorola's Entertainment pack costs $9.95 a month. These costs are actually one-time fees, not monthly charges.

In our story on biometric security devices ("Are You Ready for Biometrics?", February 23), we incorrectly stated that the Identicator BioLogon (*www.identicator.com*) requires users to enter a password in addition to using the fingerprint scanner. In fact, you can set the software to accept just a user name and a fingerprint to gain access.

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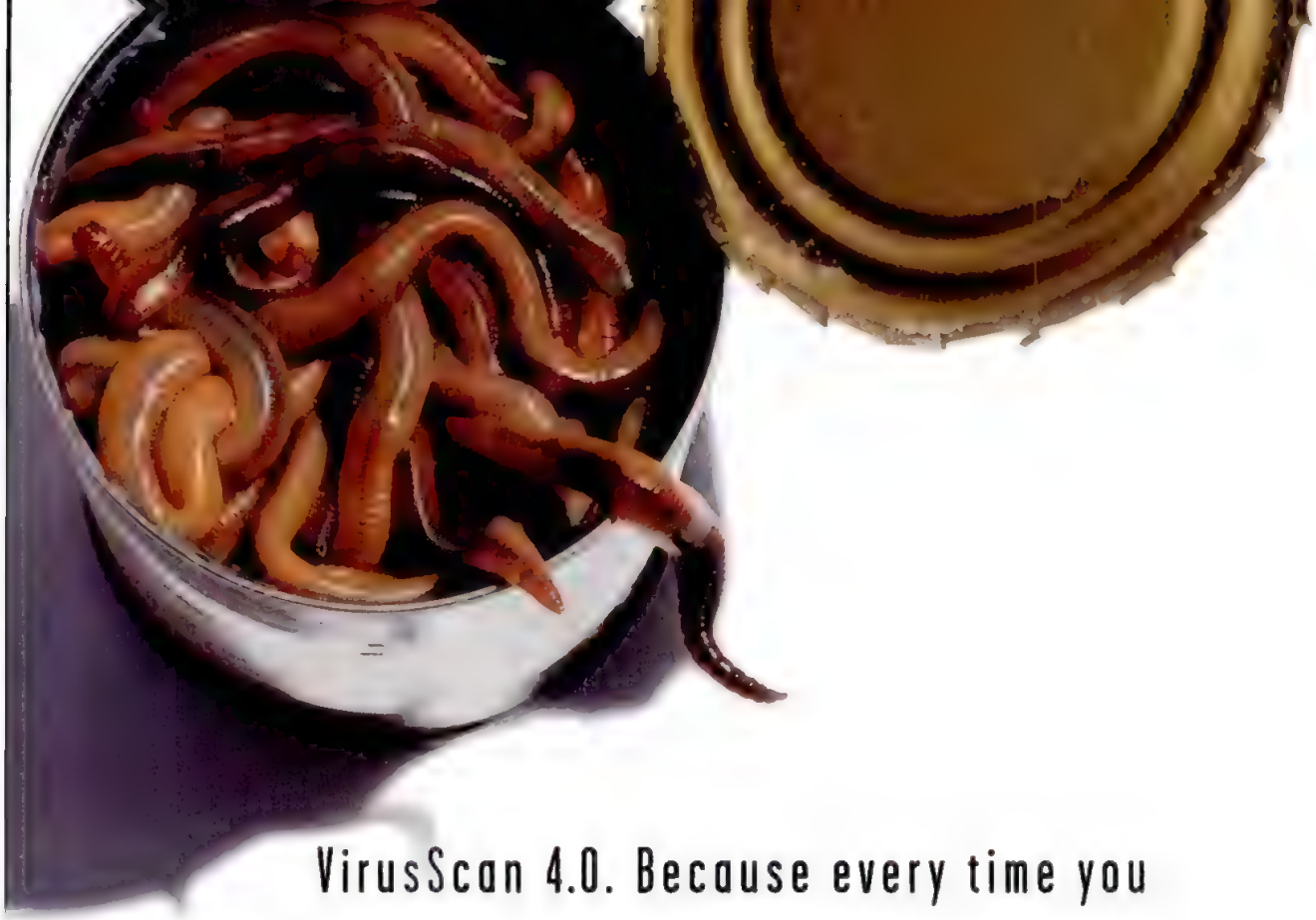

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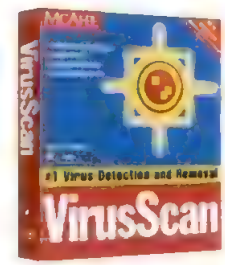

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High-IQ Homes

New Motorola DigitalDNA Lab aims to get smart appliances to talk among themselves

Picture yourself struggling home with a huge bag of groceries. You reach the front door, put down the bag, and fumble for your keys. Now, rather than going through this routine time and again, imagine if the front door recognized your face and voice and simply opened itself? This is just one of the convenient household features that researchers promise will be available to consumers of the future.

To get the ball rolling, Motorola has partnered with the MIT Media Lab to create the Motorola DigitalDNA Laboratory. Motorola has donated $5 million toward building and equipping the 5,000-square-foot facility that will house the lab. Research is already in progress, but the new building won't be completed until 2003. The lab will focus on enabling smart appliances—those that understand what you want and do it—to communicate among themselves.

The result: a networked household that seamlessly connects all sorts of appliances. Your washing machine and air conditioner will detect if they're using too much energy or making too much noise. Clothes will have labels that inform your washer and dryer which cycle to use. Doors will open for specific people or pets. Thermostats will respond to voice commands. Treadmills will check your pulse and adjust their inclines accordingly.

"Products are getting smarter, but there's a limit to what they can do for people if they're just working by themselves," says Greg Nelson, corporate vice president of Motorola's Semiconductor Products Sector. "Once you provide networks or linkages for these products, they can begin to do so much more in terms of making our lives easier," he says. One example of Motorola's current research is a wireless technology known as Piano, which can transmit information at speeds of up to 500 megabits per second over a distance of 10 feet. "It's very localized—basically the opposite of satellite networks. You walk into a room and the network is created as you enter," Nelson says.

MIT and Motorola are the most recent players to enter an already crowded field. The development of a standard way for appliances to communicate is already well underway. Sun Microsystems has recruited substantial support for its Java-based JINI technology from manufacturers of cellular phones, printers, and hand-held computers. Meanwhile, Microsoft is promoting its Universal Plug and Play technology as a common language for digital devices. —*Sharon Nash*

Let's Talk

Several developers are working on technology to let all sorts of digital devices and appliances—from microwave ovens to cellular phones—talk the same language. Once they can communicate, the possibilities are endless.

MICROSOFT'S UNIVERSAL PLUG AND PLAY
When you connect devices that support Universal Plug and Play into a network, they'll configure themselves automatically, avoiding complicated setup and configuration. For example, a camera can discover and use a printer to print a photo directly. Neither a PC nor Microsoft Windows is required.

SUN MICROSYSTEMS' JINI
Devices that support JINI can also join a network and automatically configure themselves. For example, a washing machine can detect and solve problems before the user is ever affected. JINI is based on Java technology and doesn't require any particular operating system or processor.

MOTOROLA'S DIGITALDNA
Motorola recently joined forces with MIT to develop technology for making digital devices more personalized and networkable. The new Motorola DigitalDNA Lab will focus on linking smart products, such as TVs, cars, household appliances, personal digital assistants, and wireless communications systems.

ILLUSTRATION BY VICTORIA KANN

More Trends Online • The mobile portal • The word from Microsoft's Hardware Engineering Conference • Plus: expanded versions of the stories in this section www.pcmag.com/trends

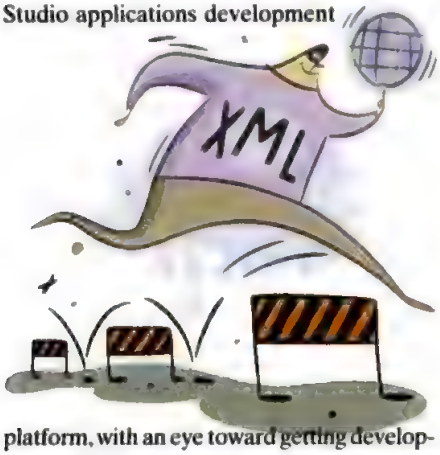
XML Speeds Ahead

After being heavily promoted as a makeover for the Web, XML (eXtensible Markup Language) is starting to live up to the hype. Recently, a slew of announcements from giant backers and the formation of new consortiums have delivered a shot of adrenaline to the promising new standard designed to describe the contents of Web pages.

The current standard for producing content on a Web page—HTML—doesn't catalog the page's contents for intelligent searching. XML, a subterranean mark-up language for tagging and describing content, is intended to function like an intelligent library card catalog. It should make Web searching more robust and assist with the functions of programs such as intelligent assistants, or bots, which scour the Web for the best prices on products.

Microsoft is supporting XML broadly in its Office 2000 application suite by making XML a supported file format. Microsoft is also incorporating XML into its upcoming BizTalk framework for building and maintaining e-commerce sites. In this instance, XML could help programs such as shopping bots pin down the best deals on Web-based product offerings.

IBM recently announced that it will deliver an XML toolkit as part of its WebSphere Studio applications development



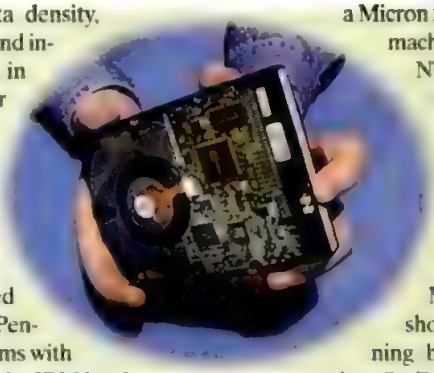
platform, with an eye toward getting developers to XML-enable e-commerce sites. Sun Microsystems has also just announced that it will add extensions to Java designed to integrate XML documents with Java applications.

XML may have a bright voice-related future as well. A consortium of companies, including AT&T, IBM, Lucent, and Motorola, recently formed the Voice Extensible Markup Language Forum. The group intends to develop XML-based methods for making Web content accessible and searchable by telephone.—*Sebastian Rupley*

What Makes a Hard Disk Fast?

If asked which Ultra DMA hard disk with a 512K on-board cache is faster—a 14GB, 7,200-rpm IBM Deskstar 14GXP drive with a 9.5-ms average seek time or a 17GB, 5,400-rpm Maxtor DiamondMax 4320 drive with a 9.0-ms average seek time—you'd probably say the IBM. And you'd be wrong. The 5,400-rpm Maxtor drive actually performs similarly to the 7,200-rpm IBM drive on our Winstone and Disk WinMark benchmark tests.

PC Magazine Labs identified several factors other than rotational speed and access time that affect hard disk performance. Drive geometry, data density, speed of electronics, and innovative techniques in the drive controller and firmware can significantly influence performance.



For our story "The Ultimate Upgrade Guide" (March 9, 1999), we upgraded various Pentium and Pentium II test-bed systems with both the Maxtor and the IBM hard disks. Across all systems, the drives' scores were within 3 percent of each other. We'd never seen a 5,400-rpm drive performing equivalently to a 7,200-rpm drive, so we investigated further.

The IBM drive uses five platters and ten read/write heads, compared with the Maxtor's four platters and eight heads. Because both the IBM and Maxtor drives have maximum data-transfer rates of approximately 22 MBps to and from the media's surface, they perform similarly during large sequential data transfers. Given that the Maxtor spins slower than the IBM, has fewer platters, but has a larger data capacity, it must either store more data per track or have a greater track density.

It turns out that though both drives have roughly 13,000 tracks per inch; the Maxtor has 230 to 384 sectors per track from inner to outer recording zones, versus the IBM's 165 to 265. Therefore the Maxtor holds more data per track, which means the unit can read or write more data per disk revolution compared with the IBM. The Maxtor also has a 0.9-ms track-to-track seek time, versus the IBM's 2.2 ms—a big difference. Just as important, IBM's drive started shipping in early 1998, and Maxtor's drive was released late in 1998, which gives Maxtor a design-time advantage.

We ran additional ZD Winstone 99 and ZD Disk WinMark 99 tests on both drives on a Micron 500-MHz Pentium III machine running Windows NT using a FAT16 partition. The IBM drive scored 5 percent lower on our Winstone tests and 15 percent lower on Business Disk WinMark tests. High-End Disk WinMark scores also showed the Maxtor winning by a few percentage points. On Disk WinMark 97's low-level sequential read/write and random read/write inspection tests, the Maxtor performed better on all write operations, and the IBM performed better on read operations.

We used Intel's Ipeak Storage Toolkit 2.2, a software utility developed by Intel Architecture Labs to assist disk vendors in analyzing their products' performance and finding bottlenecks (see *http://developer.intel.com/design/ipeak/stortool*). Intel's Web site indicates that Maxtor uses the Toolkit to optimize its drives. Intel's lead engineer responsible for the Toolkit's development, Knut Grimsrud, analyzed our Toolkit data for both drives. He noted that the Maxtor had a more sophisticated write-buffering scheme than the IBM, resulting in better write performance despite a slower rotational rate.—*Nick Stam*

THE SPINNERS: ***How does a 5,400-rpm hard disk outperform a 7,200-rpm drive? Although the IBM drive spins faster than the Maxtor drive, the Maxtor handles more data per track and performs write operations more efficiently.***

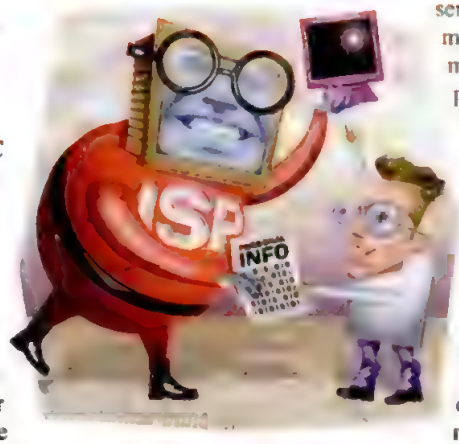
High scores are best Bold type denotes first place	ZD Winstone 99	ZD Business Disk WinMark 99	ZD High-End Disk WinMark 99
IBM Deskstar 14GXP Model DTTA-371440 (7,200 rpm)	31.2	3,570	6,520
Maxtor DiamondMax 4320 Model 91728D8 (5,400 rpm)	**32.8**	**4,230**	**6,630**

We tested both drives in a Pentium III 500–based Micron Millennia MAX 500 under Windows NT 4.0 SP3, using a 2GB FAT16 partition.

ILLUSTRATION BY HARRY CAMPBELL; PHOTOGRAPHY BY THOM O'CONNOR

DESKTOP PCS

More Free PCs



Hundreds of thousands of people have been happy to share their intimate demographic details and have their Internet usage tracked—all for the possibility of a free PC. The recent frenzy over Free-PC's offer to give away 10,000 333-MHz PCs provided the proof. Riding that enthusiasm, several companies plan to offer customers free PCs along with paid Internet access.

Free-PC asked interested callers questions about all sorts of personal details, including address, phone number, birth date, marital status, household income, hobbies, and more. The intrusion into people's privacy didn't seem to bother callers. Over one million people signed up and are waiting to see if they're part of the lucky 10,000. The major downside to Free-PC's plan: A sizable portion of each computer's screen constantly displays advertisements.

Getting a free PC along with your paid ISP account is a new twist on the model, and several ISPs are trying it out. Empire .net is offering 300-MHz PCs to users who sign up for the company's $29.95 per month Internet service for three years. Canadian company OA Group offers free 233-MHz PCs to customers who pay $35 per month for 60 hours of Internet access. The length of the contract is also three years and is limited to Canadian residents for now.

Newcomer DirectWeb offers a PC to every customer who signs up for its monthly Internet services. The company has three tiers of service: Basic (at $19.95 per month), Family ($29.95 per month), and Elite ($49.95 per month). The basic service includes a 333-MHz PC. The higher tier packages include printers and larger monitors. And the Elite level offers more-powerful systems. Every three years, subscribers will be able to upgrade to the latest hardware specifications for their tier. DirectWeb's initial offering of 25,000 PCs is restricted to the Philadelphia area, but the company plans to be national by the end of the year.

DirectWeb will receive a percentage of subscribers' online purchases. The company will keep track of customers' Internet usage but promises to maintain individual privacy. —*Sharon Nash*

Fast Microprocessors Are Like Fast Trains

Jake Kirchner

Like me, you probably also wonder why Intel gives its generations of microprocessors such bucolic code names as Deschutes, Tillamook, and Katmai but then rolls them out with names that rival those of popes and medieval heads of state: Pentium the III, Celeron the Meek, and Xeon the Magnificent.

No doubt the final names are just another sign of the nearly religious faith in technology that imbues so many companies in this industry and helps drive personal computing forward. You don't have to be a Macintosh zealot to share that faith. Just ask the thousands of investors pushing Internet stock prices to improbable heights.

Many of us share to some extent a basic faith in digital technology. Despite the bugs, systems crashes, Y2K fiasco, and perceived assault on personal privacy inherent in our growing dependency on computers, we still want the technology to keep moving forward.

And to a certain extent, this faith is just part of humans' love for, fascination with, and reliance on technology of all kinds. Necessary or not. Beneficial or not.

Did the French have to make a train, the TGV, that can top 300 mph? Maybe not, but I was grateful for that kind of engineering prowess recently, when I took a similar high speed train, the Thalys, from Brussels to Paris in under 90 minutes. As I sat, wine glass in hand, watching as we flashed by the seemingly stationary speedsters on the adjacent highway, I remembered that several days earlier I had endured an 11-hour bus ride covering roughly the same distance—from Kolding, Denmark, to Hannover, Germany.

In Kolding, I had visited the American Power Conversion Corp. plant, which makes the huge UPS systems that are as common as Cisco routers to the ISP systems running the Internet. I admit that Kolding, a small town hours from any major city, probably doesn't warrant high speed train access, but after sitting for almost 3 hours on a bus stopped dead behind a truck accident that left what appeared to be several tons of frozen chicken parts strewn across the highway, I would have been grateful for any kind of train.

The TGV doesn't travel at top speed along every mile of track. But the power is there when you want it.

Not everyone shares that faith, of course. I've read many articles on the new Intel Pentium III processor that declare the additional power and speed completely unnecessary, given the average person's use of a PC as primarily a word processor and Internet-access device. The antispeed argument seems based on the suspicion that Intel and AMD make faster chips for the sole purpose of inducing perfectly happy PC users to buy new machines.

Intel and AMD aren't charitable organizations, of course, but what the power naysayers miss is that even though you may not need the additional speed and graphics capabilities of those companies' new processors today, someday you will. And they miss the fundamental point that technology's nature is to advance.

But some people are just by nature contrary. Some people just lack faith. Perhaps we need people like that to help us keep technology in perspective. Fine. I'm happy to volunteer them to turn out on the cold rainy highway at night and help pick up thawing chicken parts. For myself, I'll take the train, thank you.

ILLUSTRATION BY OCTAVIO DIAZ; PHOTOGRAPHY BY JAY REED

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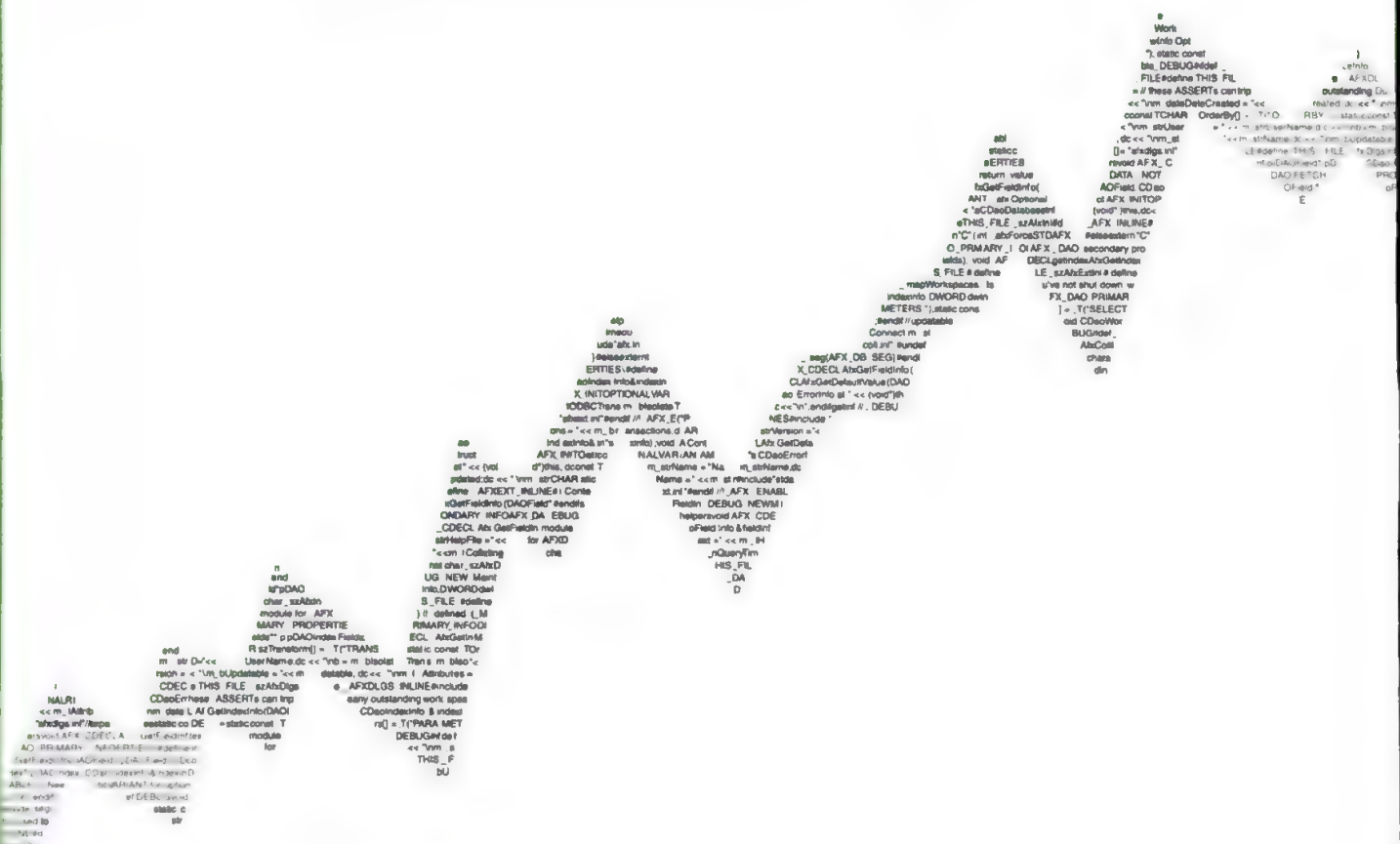

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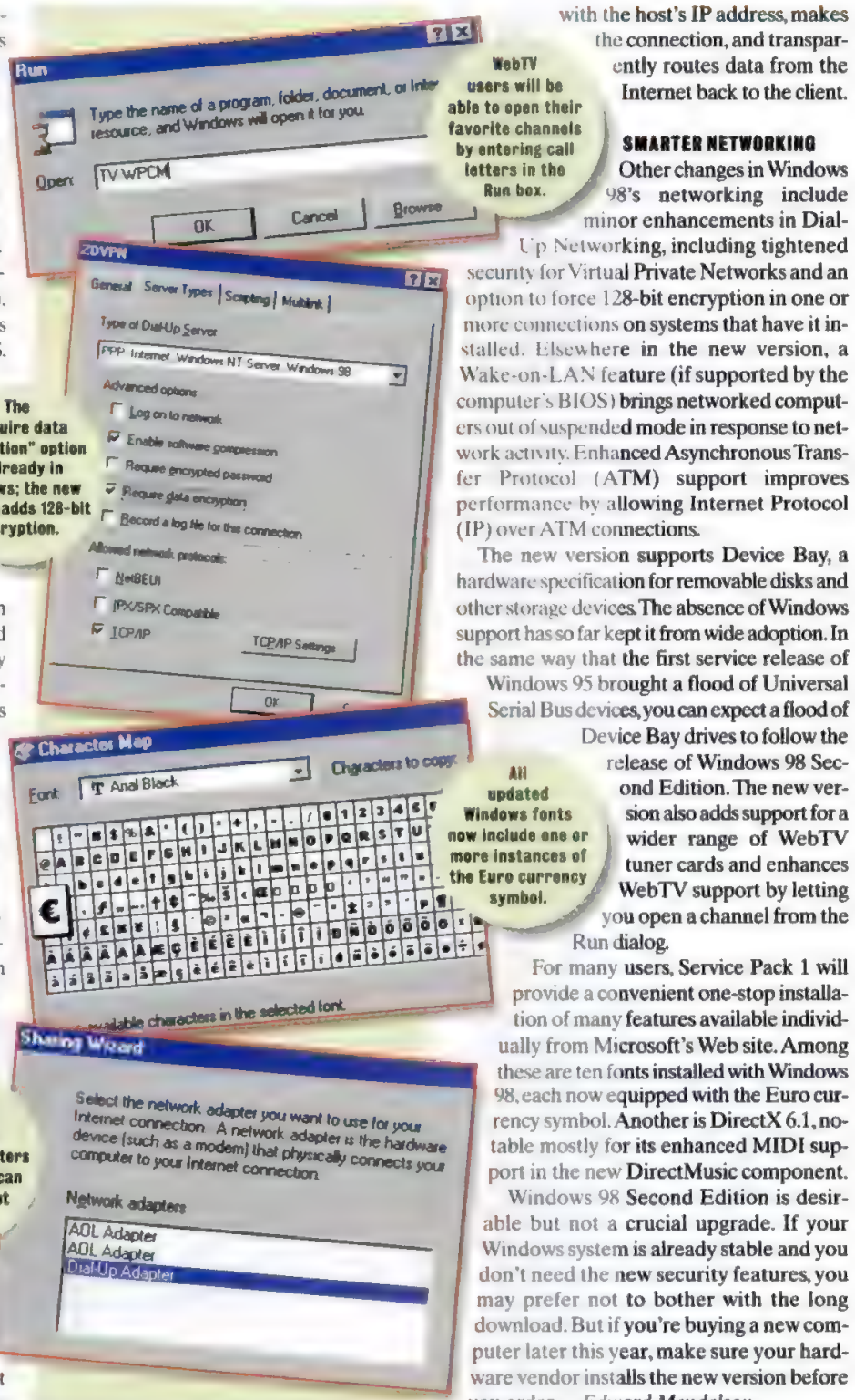
OPERATING SYSTEMS

Windows 98 Second Edition

Microsoft Windows 98 Second Edition is scheduled to ship on new PCs and in retail boxes in the fall of 1999. Current Windows 98 users will be able to download most but not all of the new version from Microsoft's Windows Update Web site. The downloadable version will consist of two parts: Microsoft Internet Explorer 5 and revised core components of the operating system, to be called Windows 98 Service Pack 1. The only new feature unavailable for download is Internet Connection Sharing (ICS), which lets networked Windows 98 systems share a single Internet connection. To get ICS, you'll need to spend $80 (street) for a new CD-ROM containing the complete Second Edition, installable as an upgrade to Windows 3.1 or Windows 95, buy the Second Edition preinstalled on a new PC, or order a $19.95 upgrade CD-ROM.



SUBTLE CHANGES

A prerelease version of the Second Edition was recently distributed to beta testers, and *PC Magazine* examined it. Users who already have Internet Explorer 5 installed over an existing Windows 98 setup will see no obvious differences. The Desktop, Start menu, and Explorer windows look the same. Windows' built-in applications look and act exactly as before. The new beta seems more stable than the original Windows 98, reflecting many bug fixes in the core Windows files, but performance seems identical.

The most obvious change is Internet Connection Sharing, which adds a feature previously available in Windows 98 only through third-party networking software. When ICS is installed on a home or small-office network, all networked client computers can access the Internet through a single host computer. The host can use any existing Internet connection. Installation is simple: In the Add/Remove Programs applet in Control Panel, choose the Windows Setup tab and select Internet Connection Sharing. A dialog box asks which adapter you use to connect to the Internet; the rest is automatic. When a client computer connects to the Internet through the host computer, ICS replaces the client's IP address with the host's IP address, makes the connection, and transparently routes data from the Internet back to the client.

SMARTER NETWORKING

Other changes in Windows 98's networking include minor enhancements in Dial-Up Networking, including tightened security for Virtual Private Networks and an option to force 128-bit encryption in one or more connections on systems that have it installed. Elsewhere in the new version, a Wake-on-LAN feature (if supported by the computer's BIOS) brings networked computers out of suspended mode in response to network activity. Enhanced Asynchronous Transfer Protocol (ATM) support improves performance by allowing Internet Protocol (IP) over ATM connections.

The new version supports Device Bay, a hardware specification for removable disks and other storage devices. The absence of Windows support has so far kept it from wide adoption. In the same way that the first service release of Windows 95 brought a flood of Universal Serial Bus devices, you can expect a flood of Device Bay drives to follow the release of Windows 98 Second Edition. The new version also adds support for a wider range of WebTV tuner cards and enhances WebTV support by letting you open a channel from the Run dialog.

For many users, Service Pack 1 will provide a convenient one-stop installation of many features available individually from Microsoft's Web site. Among these are ten fonts installed with Windows 98, each now equipped with the Euro currency symbol. Another is DirectX 6.1, notable mostly for its enhanced MIDI support in the new DirectMusic component.

Windows 98 Second Edition is desirable but not a crucial upgrade. If your Windows system is already stable and you don't need the new security features, you may prefer not to bother with the long download. But if you're buying a new computer later this year, make sure your hardware vendor installs the new version before you order.—*Edward Mendelson*

Know Your Cyber-Rights

By Alan Cohen

The Internet has created a whole new set of headaches for legal minds to ponder. The problem is simple: Most laws were written before the Internet was conceived, and figuring out how even the most basic doctrines apply to cyberspace has kept judges, legislators, and an army of lawyers busy. Yet while the professionals struggle with answers, the rest of us are left with a slew of important questions: Can my boss read my e-mail? Can I copy a Usenet posting and send it off to friends? What happens if a company says my domain name infringes on its trademark? The following sites help to explain the emerging law of the Internet—and help you stay clear of trouble.

Who Can Read My E-Mail?

➤ In just a few years, e-mail in the workplace has gone from a novelty to a necessity. But let's be realistic: Not all messages are business-related. Can your boss read those Monday morning missives where you let off a little steam at his expense? If you used the company's equipment, absolutely. A good place to learn the rules of the road is the **American Civil Liberties Union**'s excellent Freedom Network (*www.aclu.org*). There you'll find an essay titled "Privacy in Cyberspace: Is Your E-mail Safe from the Boss, the SysOp, the Hackers and the Cops?", by ACLU attorney Ann Beeson. It does a nice job summarizing your privacy rights in the online world—rights that are less than you probably think. For example, though an employer may be prohibited from listening in on your private telephone conversations, e-mail is fair game. But the news isn't all bad. If an employer establishes specific policies regarding e-mail, those policies are binding. This is one handy bit of information you can pick up at the **Privacy Rights Clearinghouse** (*www.privacyrights.org*), which provides a set of useful "Fact Sheets," including one on employee-monitoring.

The Law of the Web

➤ When will such common techniques as framing, linking, and metatagging land you in legal hot water? The **Berkman Center for Internet and Society** at Harvard Law School (*http://eon.law.harvard.edu/property*) has created a fascinating online course entitled "Intellectual Property in Cyberspace," part of a continuing series of classes taught by Harvard Law professors. These latest lectures took place over a six-week period beginning in March, but a wealth of material is still available at the site, including readings, analysis, hypothetical cases, and background information on topics such as ISP liability, legal protection for Web sites, and the application of copyright law to the Internet.

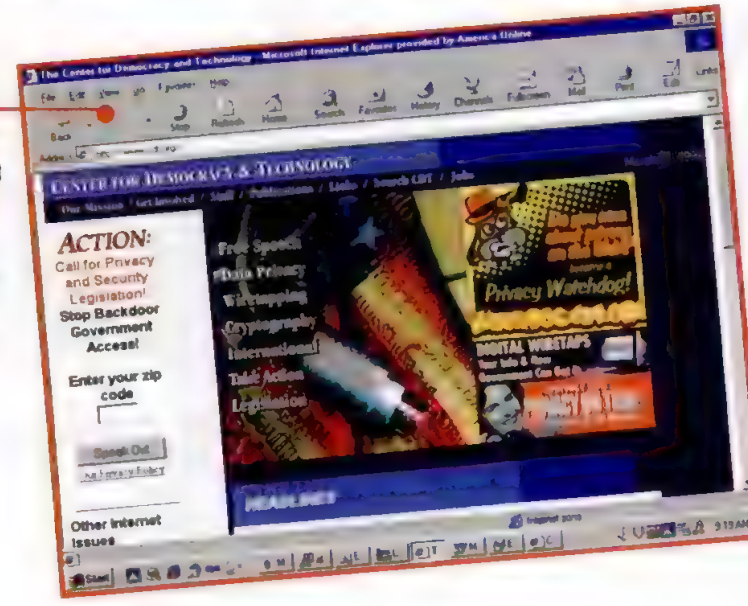
Cambridge isn't the only place where you can come up to speed on copyright dos and don'ts. Two Internet-savvy attorneys have created Web pages that explain all the basics. **Lawgirl** (*www.lawgirl.com*) is a hip-looking site that features a wicked sense of humor, a moderated question-and-answer board, and a handy guide to registering online works. **The Copyright Website** (*www.benedict.com*) takes a look at copyright issues involving newsgroup postings, as well as the fair-use doctrine, which allows certain uses of copyrighted work.

Domain Name Disputes

➤ Harvard's Web site also does a good job covering a particularly high-profile area of Internet law: domain names. Conflicts between domain names and trademarks have kept many courts occupied, as has a related phenomena known as *cybersquatting*, where someone registers as a domain name the trademark of another, hoping the trademark owner will pay top dollar to obtain the URL. A great place to get up to speed on these issues is the **patents.com Intellectual Property Law Web Server** (*www.patents.com*), run by the law firm of Oppedahl & Larson. What this site lacks in design it more than makes up for in content, taking an in-depth look at the controversies surrounding domain names.

Protecting Cyber-Liberties

➤ Understanding how established laws apply to cyberspace is just half the battle. Legislators are introducing a host of new Internet-related statutes on subjects ranging from encryption to content-regulation. The ACLU, **The Center for Democracy and Technology** (*www.cdt.org*), and the **Electronic Privacy Information Center** (*www.epic.org*) do an outstanding job keeping you informed on the latest happenings in Congress and across the states. A handy feature at the ACLU's site lets you instantly fax or e-mail representatives to protest bills that may infringe on civil liberties. EPIC offers a convenient page listing all pending federal legislation involving privacy issues (complete with links to the Library of Congress's Thomas site). The CDT site provides a wealth of news and analysis in a well-designed, graphics-rich format. PC



The Center for Democracy and Technology's Web site provides news and anaylsis of legislation and events that affect cyber-liberties.

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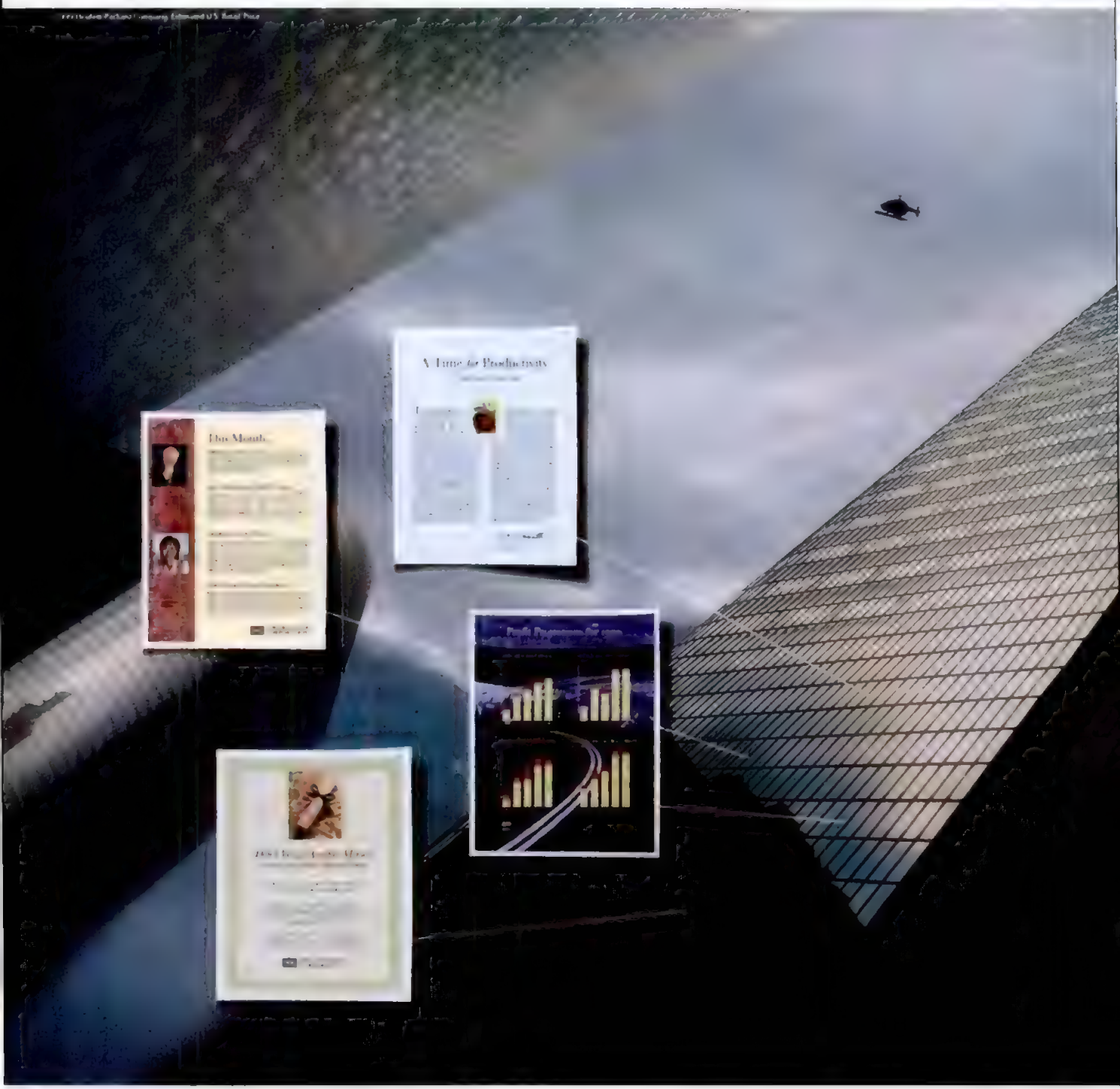

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Win CE Color Palm PCs

Palm-size Windows CE devices get a boost from color displays and added memory.

By Bruce and Marge Brown

PDAs will never be the same. The new color-screen palm-size Microsoft Windows CE devices can display pocket-size color photographic images, read news downloads, play music, and even show converted AVI and MPEG video, in addition to juggling contacts, appointments, and task lists. The new Casio Cassiopeia E-100 ($500 street), Compaq Aero 2100 ($450 street), Everex Freestyle 540 ($500 street), and HP Jornada 420 ($520 street) perform as expected with PIM data, and do so more pleasantly and efficiently thanks to color screens. But the unexpected multimedia features answer those who wonder why anyone would buy any PDA other than a 3Com Palm device.

All four units tested for this roundup should be available for purchase by the time you read this. Expect shortages similar to those experienced with the first color H/PCs from Hewlett-Packard, NEC, and Sharp; prices probably won't drop for a while.

Also, though all of the vendors express enthusiasm for the addition of color to this platform, we expect that initial build quantities will be low while manufacturers assess initial market reaction. Based on what we saw in testing, there's no reason to wait for prices to drop or for ramped-up features. All of these color P/PCs offer enhanced productivity features and surprisingly worthwhile entertainment capabilities.

SPEC SHEET

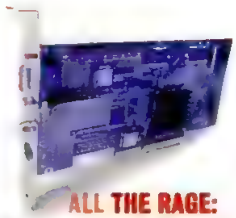
These four Windows CE palm-size PCs each weigh about 9 ounces, including rechargeable batteries, and measure approximately 5.2 by 3.3 by 0.8 inches (HWD). The Compaq and Everex devices are slightly heavier, and the Everex and HP devices are slightly thicker. They still don't load applications and data as quickly as the 3Com PDAs do, and battery life and an uncluttered user interface remain 3Com advantages.

These devices share numerous hardware features: Each has a 320-by-240–resolution touch screen, one Type II CompactFlash slot, an infrared port, a voice recorder with a built-in microphone and speaker, and a docking cradle with a serial cable to connect with a host PC. Standard software emphasizes PIM and convenience applications: Each device has Pocket Outlook (which includes Contacts, Task, and Schedule programs), plus a calculator, world clock, note taker, and voice recorder. The latest P/PC platform runs Windows CE 2.11 on the PDA and Windows CE Services 2.2 on your PC.

All four devices we tested use rechargeable, proprietary-size lithium ion batteries. The vendors rate battery life ranging from 6 hours of continuous use to two weeks of intermittent use. But if you plan to play MP3 music or keep the display at the brightest setting, a spare battery will be essential.

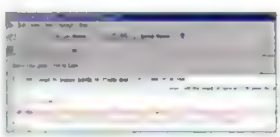
DISPLAYS AND SUCH

The biggest differences among the devices are in display type used (two types of TFT and one passive-matrix screen) and color depth supported (three have 8-bit, 256-color support, but the Casio unit boasts 16-bit, 65,536-



ALL THE RAGE: We put the long-awaited ATI Rage Fury graphics card through its paces. *Page 51.*

A NATURAL: With Dragon Naturally-Organized, the vendor adds synchronization to its organization arsenal. *Page 64.*



EASY ETHERNET: Plug-n-play comes to the network in the form of the new 3Com USB Network Interface. *Page 76.*

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IBM ThinkPad 570 46
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PHOTOGRAPHY BY THOM O'CONNOR

color support). Audio output mode also varies (only the Casio device has stereo), as does the placement and arrangement of user control buttons.

The Casio Cassiopeia E-100's TFT active-matrix screen not only was the only one here with 16-bit, 65,536-color support, it was also the brightest. The Compaq and Everex units both use reflective-TFT displays: These panels aren't as bright as regular TFT when viewed indoors, but they were easily the most visible in daylight. (These two devices also appear to have been manufactured by the same source, although their control buttons are different.) And the HP Jornada 420's passive-matrix display fell right in the middle: It was not quite as bright as that of the Casio unit, but it was brighter indoors than those of the Compaq and Everex units.

LISTEN UP: *Play MP3 music files with MPegTV, LLC's Xaudio for Windows CE.*

SPEAK UP: *Audible's AudiblePlayer turns a Windows CE P/PC into a spoken audio player.*

MULTIMEDIA MAVENS

To think of a 9-ounce device as a versatile multimedia product may seem odd, but in testing we found these P/PCs suitable for viewing digital images and short video clips and listening to electronic books and MP3 music files. We ran a late beta version of Sierra Imaging's Image Expert 2.0 for CE, which lets you organize, view, edit, annotate, and run slide shows of digital images.

We loaded Audible's AudiblePlayer (bundled with all but the HP units) and MpegTV's Audio MP3 player. Audio books from Audible and MP3 music files played clearly via the internal speakers on the Casio, Compaq, and Everex units, but were more enjoyable when listened to with headphones. We were particularly impressed with the Cassiopeia's stereo headphone signal. The Jornada 420 couldn't play either Audible book files or MP3 music files—a known problem that HP is working on. (For a review of Audible's new 7-hour player, go to our Web site, *www.pcmag.com*.)

We also had a look at the future when we ran a beta version of a Casio program that plays video files on the Cassiopeia. A multimedia option pack from the company (expected later this spring) will include an MPEG and AVI desktop video-file converter, the video player, and a music player.

Video clips will definitely consume massive amounts of storage space and will likely burn through battery life. But with the eye's ability to adjust to video source size, these color P/PCs could become a significant medium for viewing videos. You should figure on investing in several CompactFlash cards; they're available now in capacities ranging from 4MB to 96MB (and soon, 160MB), but they are expensive, with prices ranging from $3 to $5 per megabyte.

PHILIPS' COLOR P/PC

We also took a look at a final beta version of the Philips Nino 500 ($500 street; *www.nino.philips.com*), which is expected to ship at the end of April. Slightly lighter than the other color palm-size CEs, the Nino 500 shares the tapered stylistic design and easy one-handed operation of the Philips monochrome models. The device also comes with an impressive selection of software, including four methods of text entry.

The Nino 500's display quality is similar to that of the Casio Cassiopeia E-100, with software controls for both brightness and contrast. The unit is 15 percent lighter than the average device here, weighing 8.2 ounces including battery. Notably, the Nino 500 uses nickel hydride batteries in the standard double-A size, and it can also run on regular alkaline batteries—a bonus if you run out of power with no time to recharge.

Usability is a strong feature of the Nino, particularly if you're right-handed. With the stylus in your right hand, you can hold the device in your left hand to operate buttons on the left side of the case with your thumb, and the buttons on the right side with your fingers. These usability features, a good screen, and an impressive array of software make the Nino 500 an attractive choice—as long as you won't miss stereo sound and 65,536-color support.

THE VERDICT

Some users will quickly be drawn to small color-screen PDAs; mobile professionals will see the voice-playback capabilities plus the potential to replace portable cassette and CD players as a great way to lessen travel loads. And software availability is liable to increase rapidly as vendors and users realize the possibilities of this cool, compact format.

But if you aren't interested in these CE machines' multimedia capabilities, you should consider a machine like the 3Com's Palm IIIx: It costs less, works quickly, and performs all PIM functions extremely well.

Casio Cassiopeia E-100

PC MAGAZINE EDITORS' CHOICE

Hands down, the Casio Cassiopeia E-100 is the best suited P/PC here for multimedia. With its bright 64K color, TFT active-matrix display, stereo headphone jack, and fast 131-MHz CPU, the 16MB Casio unit comes out of the box ready to work and play. Its extra features and fabulous screen add up to our Editors' Choice award.

The Cassiopeia's shiny silver case is attractive though plain in form, with straighter edges than the hand-welcoming shape of the Everex Freestyle 540. The number and arrangement of user control buttons—the least intuitive among the tested devices—include three programmable application buttons and a flush-mounted joystick on the front, plus a power button, a selection and action wheel, an exit button, and a fourth application launch button on the left. A small, removable cover for the CompactFlash slot is so easy to lose that we lost it, despite our best efforts not to.

The color display was a pleasure to use indoors, in varied lighting. It's bright and responsive enough that one of our testers

Editors' Choice

• Casio Cassiopeia E-100

PC MAGAZINE EDITORS' CHOICE

We think that the potential for pocket multimedia is the big deal about Windows CE palm-size PCs—so the Casio Cassiopeia E-100 is the clear Editors' Choice selection in this roundup. Its extremely bright screen with 16-bit, 65,536-color depth and stereo audio headphone jack are unmatched by models from the other manufacturers, making the Casio unit the best choice for viewing digital images and for listening to music. The Cassiopeia runs all the P/PC productivity software, of course, but the entertainment capabilities of this model are also impressive (particularly with the Multimedia option pack, $70 street).

Taking a step down in multimedia capabilities but a step up in convenience, the Compaq Aero 2100 and the functionally identical Everex Freestyle 540 each boast a dual-mode speaker and microphone jack, and both include a stealthy (but elusive) vibration alert mode. The reflective TFT screens used by both models are particularly good for outside viewing.

The HP Jornada 420 has the only passive-matrix display of the tested models, but it was impressively bright, particularly indoors. The Jornada 420's flip-over protective display panel guards the most vulnerable part of the device and is quite sturdy, if sometimes a minor nuisance when you forget to flip it.

was able to play Solitaire while riding a LifeCycle and listening to MP3 music tracks via stereo headphones plugged into the unit's audio jack. Clearly, this device begs you to find multiple ways to use it. In daylight, the screen is no better than most TFT displays; using it is possible but not particularly easy.

Bundled with the Casio unit is AudiblePlayer, a Palm conversion program, and a CompactFlash backup program. Optional accessories include a cassette adapter ($13 street), a screen protector ($9), and the CD-Casio Multimedia Pack ($70), which includes an MP3 audio player, a desktop movie file converter, a movie player, and Palm Golf.

The Casio Cassiopeia E-100 is an able performer for traditional PDA tasks, but as a pocket multimedia device, it really shines.

Compaq Aero 2100

The Compaq Aero 2100, which revives a brand name used years ago for an early lightweight notebook PC, is nearly identical in most features and functions—though not in design—to the Everex Freestyle 540. The Aero is the least expensive device in this roundup at $450, although that's with only 8MB of RAM; a $500 16MB model is also available. The Aero is aimed at mobile professionals and enterprise applications, markets reflected by the Compaq's bundled software, which includes Compaq Asset Viewer and CF Backup.

The unit's reflective 320-by-240 resolution, 256-color display is clear and readable under inside lighting, though it's not as bright as the Casio and HP units' screens. But in daylight, this display type (also used with the Everex model) is easily the most visible. The Compaq device has two brightness levels, selected via an icon on its taskbar (but hidden in a menu on the Everex unit).

User controls include four application buttons and a power and backlight button on the front, one-touch audio on top, plus a selection and action wheel and an exit button on the left side. Like the Everex unit, the Compaq device uses a removable card blank in its CompactFlash slot, rather than a door to cover the slot. This design is realistic, but unless you're extremely careful, you're likely to lose the blank if you use CF cards very often.

The unit's monaural sound proved surprisingly clear. We had fine results from recording voice memos using the internal microphone and speaker. Avid voice-memo takers will find the combination 25-mm audio jack a great convenience. A headset microphone isn't included, but in testing with a standard set from a telephone, the recorded sound quality was excellent.

All Windows CE P/PCs use a flashing light and audible alert for task or appointment alarms, but the Compaq Aero 2100 also has a vibration alert (as does the Freestyle), though it's not easy to find. Only by searching through online documentation did we find that if you deselect the audio signal on the alarm-options screen, the vibration mode is activated.

Everex Freestyle 540

Although the Everex Freestyle 540 shares many attractive features with the Compaq unit—including a reflective TFT display, dual-mode monaural headphone/microphone jack, and silent (but hard to find) vibration-alarm mode—it has several unique features. One minor but unfortunate difference is that using the dual-mode brightness

SUMMARY OF FEATURES

Windows CE Color-Screen Palm-Size PCs

PC MAGAZINE EDITORS' CHOICE

	Casio Cassiopeia E-100	Compaq Aero 2100	Everex Freestyle 540	HP Jornada 420
Street price	$500	$450	$500	$520
CPU	NEC VR4121	NEC R4000 series	NEC VR series	Hitachi SH7709a
Speed	131 MHz	70 MHz	66 MHz and up	100 MHz
Memory (ROM / RAM)	16MB / 16MB	12MB / 8MB	10MB / 16MB	8MB / 8MB
Screen technology	Active-matrix TFT	Reflective active-matrix TFT	Reflective active-matrix TFT	Passive-matrix CST
Color depth	65,536 colors	256 colors	256 colors	256 colors
Brightness settings	1, with variable contrast	2	2	11, with variable contrast
Battery type/Rated life	Lithium ion / 6–8 hours	Lithium ion / 10 hours	Lithium ion / 10 hours	Lithium ion / 6 hours
Charge time	1.5 hours	2–3 hours	2 hours	3–4 hours

setting requires you to access a menu rather than to use the convenient taskbar icon found on the Compaq device. But the Freestyle is an enjoyable device, particularly well-suited for outside use and for people who will use the voice recording feature.

The Freestyle's two-tone gray and silver case has tapered sides, curved in the middle for easy holding. It also has a unique dual-handed feature, with a selection wheel and single button on each side of the device. In default mode, the wheel and button on the right side are used for volume control and to start and stop voice recording, while the controls on the left side are used to select, choose, and exit actions. A settings-menu item switches the button assignments: Left-handed users will rejoice.

Everex bundles an impressive amount of software with the Freestyle, including AudiblePlayer; bSquare Corp.'s bProductive (bTrack, bFax Express, bPrint, bMobile New, and bViewer); Microsoft Powertoys, and Quicken's Expensable On-the-Go. All in all, the Everex Freestyle 540 is especially suitable for mobile professional users.

HP Jornada 420

The HP Jornada 420 is a finely built color P/PC with a removable, clear-plastic display cover that flips over the back for touch-screen access. The dark-purple Jornada 420's 8-bit, 256-color, 320-by-240-resolution, passive-matrix CST display was the second brightest screen indoors (next to the Casio unit) and average outside. Eleven adjustment levels—each for brightness and contrast—come in handy.

Other compelling design features include a travel-size docking cradle, which has a positive lock to hold the P/PC in place that's released by a pair of buttons on the cradle's side. Flush-mounted application-launch buttons at the bottom of the screen are protected by the display cover (if unprotected buttons on the other models are pushed accidentally, the units could turn on and waste battery life).

The Jornada 420 has a tiny power/brightness button on the front, with all other buttons on the left, including a red voice-recorder button, a start-menu button, and selection, action, and exit buttons. The door for the CompactFlash card slot, on top of the device, is awkward to replace when a card is inserted. The Jornada 420 was not able to play either spoken voice files from Audible or MP3 music files successfully. HP reports that it is working on a solution.

This unit is bundled with several productivity utilities and applications but no multimedia programs—not surprising, given its target audience of mobile professionals and enterprise customers. Software that comes in ROM or on a supplementary CD-ROM includes LandWare's OmniSolve math and scientific problem-solving tool, bTask, CF Backup, and

EZExplorer. Optional accessories for the Jornada 420 include an external keyboard that plugs into the serial port and a clip-on 56K V.90 modem ($160). PC

HP's New H/PC Pro: The Jornada 680

If you want a color PDA but need a better way to compose memos and work with e-mail than using a tiny P/PC screen, the latest Windows CE Professional model released by Hewlett-Packard may interest you. The Jornada 680 ($900 street) has a real keyboard, an internal 56K V.90 modem, and a half-VGA, 640-by-240-resolution, 256-color, 6.5-inch diagonal display. At 18.6 ounces, with battery, the Jornada 680 is larger too, measuring 3.5 by 7.3 by 1.6 inches (HWD). The device is the latest update to the company's 600 series of color H/PC devices, following the HP 620LX and HP 660LX. The Jornada 680 fits in between the (relatively) large-format Jornada 820 Jupiter-class device with a 640-by-480-resolution color display (First Looks, December 1, 1998) and the palm-size Jornada 420 reviewed here.

The Jornada 680 is based on a 133-MHz Hitachi SH-3 with 16MB of ROM and 16MB of SDRAM, both user-upgradable. The Jornada 680's rechargeable lithium ion battery has a rated life of 8 hours and takes 3.5 hours to charge.

There is no headphone jack on the Jornada 680, but like all Windows CE H/PC Pro devices, it includes a voice recorder with an internal microphone and speaker, Type II PC Card and CompactFlash card slots, and an IR transceiver. The keyboard is relatively tight, with 14.5-mm key spacing. For short memos and letters, though, it certainly beats using a handwriting recognition program or the tiny on-screen keyboards that come with P/PCs.

The Jornada 680, which comes with a flat-style docking station and pop-out stylus holder, is loaded with the usual Microsoft complement of H/PC Pro software including pocket versions of Microsoft Access, Excel, Outlook, PowerPoint, Word, and Explorer. Additional bundled software includes Starfish's TrueSync CE 2.0 (to synchronize PIM data with REX and REX PRO cards), Inso Corp.'s Outside In e-mail attachment viewer, On the Go Software's Pocket Quicken, an HP PIM translator, and Sierra Imaging's Image Expert.

For those who want more than a palm-size device but resist carrying anything that comes close to the size or appearance of a conventional notebook, the HP Jornada 680 is a finely tuned, portable productivity tool.

HP Jornada 680. Street price: $900. Hewlett-Packard Co., Palo Alto, CA; 800-443-1254; *www.hp.com.*

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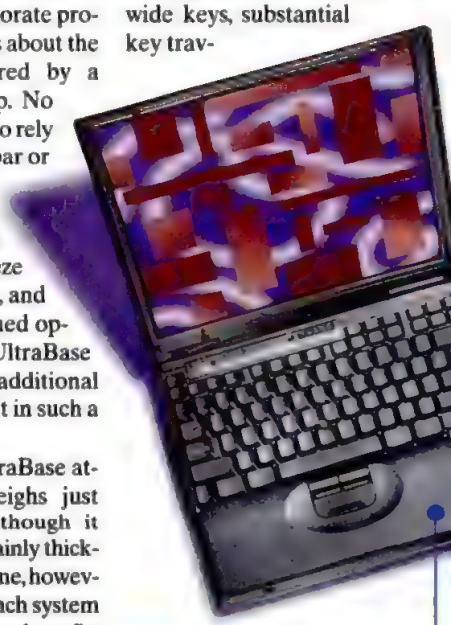
IBM Thinks Ultrathin

IBM goes the thin-and-slice route with the 4-pound ThinkPad 570—and the result is a success.

By Asa Somers

With sub-4-pound competitors such as the Sharp Actius and Sony VAIO beginning to crowd the ultrathin notebook market, the venerable ThinkPad 560Z was due for an update. And with the ThinkPad 570 ($3,600 street), IBM has attempted to ease corporate professionals' misgivings about the compromises required by a thin-and-light laptop. No longer will you have to rely on an external port bar or yearn for a DVD drive. In an amazing use of real estate, the 570 manages to squeeze all its ports onboard, and a wonderfully designed optional snap-on UltraBase ($100) provides the additional features that won't fit in such a svelte system.

Even with the UltraBase attached, the 570 weighs just under 7 pounds, although it takes on a rather ungainly thickness of 2.1 inches. Alone, however, the 4-pound, 1.1-inch system is a joy to use and carry, benefiting richly from the legendary ThinkPad fit-and-finish.



SMALL PACKAGE: *The ThinkPad 570 holds a load of power in its thin case.*

UNDER THE HOOD

Our evaluation model came loaded with a 366-MHz mobile Pentium II processor, 64MB of RAM, and a 6.4GB hard disk. On our ZD Winstone 99 performance test, this translated into a score of 17.3, in line with a similarly configured Dell Inspiron 7000.

The 570 isn't the fastest new notebook on the planet, but corporate users will be more interested in its usability features anyway, including the 13.3-inch TFT screen, which supports a maximum XGA resolution at 24-bit color. In testing, the display provided even corner-to-corner color and better-than-average off-axis viewing. A hardware-based slider located on the bezel beneath the screen let us fine-tune brightness with ease.

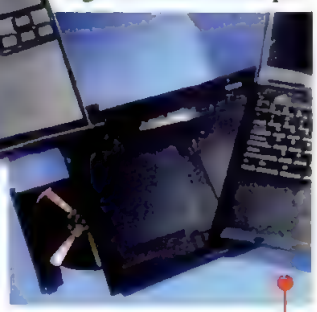
OTHER DETAILS

Thankfully, the legendary ThinkPad keyboard appears once again on the 570. With its wide keys, substantial key travel, and preferred layout, the ThinkPad keyboard replicates a standard desktop keyboard better than any we've tested. We especially like the placement and substantial size of the Backspace key and the location of the dedicated arrow keys, which are set well apart from the rest. Software-based volume key combinations worked much better than most we've seen.

The wide wrist rest's contoured center houses three actuation buttons that complement the TrackPoint IV pointing device to give you very fine cursor control. The large third button lets you scroll up and down in many applications and provides additional features when used in combination with other keys. The TrackPoint's press-to-select feature, which lets you highlight text or grab objects by tapping the pointing stick, works as advertised but takes some getting used to. For example, we were able to pick up a specific Excel spreadsheet cell successfully only after repeated attempts.

Thin systems usually mean thin batteries, which means you won't ever get more than a couple hours of work time from one of these puppies. The 570, however, is an exception to the rule. On our BatteryMark 2.0 test, the system lasted 3 hours and 6 minutes. You can install a second battery in the UltraBase if you need to work even longer.

Unlike other ultraportables, however, the ThinkPad 570 has room onboard for all the standard ports (including USB, fast IR, and parallel), obviating the need for a kludgy port bar. And the notebook comes complete with an internal V.90 modem, leaving both of the stacked Type II PC Card slots available for accessories. With a machine this thin, though, you can't expect to find any removable media drives; that's where the 2.9-pound UltraBase comes in.



NE PLUS ULTRA: *The 570's add-on UltraBase adds features to the svelte system.*

THE SLICE

One of the key features of the UltraBase is that it is fully hot-dockable with the laptop. In testing, we repeatedly snapped the powered-up notebook down into the base and disengaged it without incident. This feature is a major step forward.

The 0.9-inch-thick UltraBase adds 2X DVD and standard floppy disk drives, both of which swap easily in and out of their respective slots, thanks to well-built lock-and-release mechanisms. The UltraBase also adds dual stereo speakers, an additional USB and audio-out jack, and a MIDI/joystick connector. In keeping with the 570's elegant design, the UltraBase features a battery slot beneath the floppy disk drive bay and a dual-setting locking system that lets you fix just the two removable drives or both the drives and the notebook into place, so prying hands can't remove them.

Although audio from the UltraBase's speakers sounded relatively full and clear, video from the DVD drive was a bit jerky, in part because the system uses software decoding. Our evaluation system came loaded with Windows 98; a Windows NT version is available for $100 more. The 570 also comes loaded with Lotus SmartSuite and the classic ThinkPad configuration applet located in the Programs menu, which collects many of the most important system settings in a single place, including a highly configurable Power settings dialog.

As one of our colleagues says, "Nobody ever got fired for buying IBM." The 570 is a case in point. It's more expensive than many comparable ultrathin systems, but the extra dollars will be well spent. The 570 requires perhaps the fewest sacrifices of any ultrathin notebook to date, and the UltraBase is the most viable snap-on slice we've yet seen.

IBM ThinkPad 570. Street price: $3,600; UltraBase, $100. IBM Corp., Armonk, NY; 800-426-7255; *www.ibm.com/pc/us/thinkpad*.

PHOTOGRAPHY BY THOM O'CONNOR

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The hardest part may be choosing which one to buy. At $399*, the point-and-shoot ePhoto CL30 has an optical viewfinder and LCD screen. Filter and lens support. And fast downloads with USB.

The $799* ePhoto CL50 gives you SLR-type automatic and manual settings. Built-in flash or sync to external. 3x optical zoom. High-speed burst mode. Plus up to ten seconds of audio recording with every shot.

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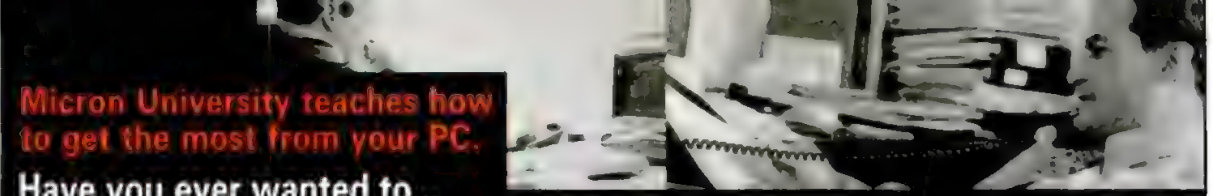

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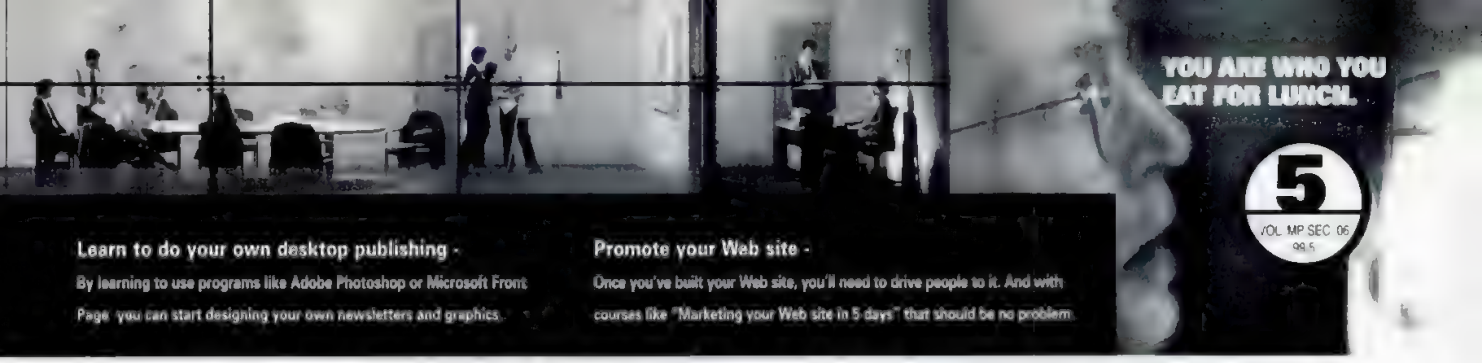

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Model Name	Millennia C400	Millennia MAX 400	New! Millennia MAX 500	New! Millennia MAX 500	New! Millennia MAX 500
Processor	Intel Celeron™ processor 400MHz	Intel Pentium II processor 450MHz	Intel Pentium III processor 500MHz	Intel Pentium III processor 500MHz	Intel Pentium III processor 500MHz
Cache	128KB integrated L2 cache	512KB integrated L2 cache	512KB integrated L2 cache	512KB integrated L2 cache	512KB integrated L2 cache
RAM	64MB SDRAM	64MB 100MHz SDRAM	128MB 100MHz SDRAM	128MB 100MHz SDRAM	256MB 100MHz SDRAM
Hard Drive	13GB Ultra ATA hard drive*	19GB Ultra ATA hard drive*	19GB Ultra ATA hard drive*	19GB Ultra ATA hard drive*	18GB Ultra ATA hard drive*
Monitor	17" Micron 700Cx monitor (15.9" display)	17" Micron 700Cx monitor (15.9" display)	17" Micron 700Cx (15.9" display) monitor	17" Micron 700Cx (15.9" display) monitor	19" Micron Trinitron (18" display) monitor
DVD/CD-ROM	40X CD-ROM drive*	40X CD-ROM drive*	40X CD-ROM drive*	6X max speed DVD-ROM drive	6X max speed DVD ROM drive
Communication	3Com USRobotics V.90 WinModem**	3Com 3C905 10/100 network card	3Com 3C905 10/100 network card	3Com USRobotics V.90 WinModem**	3Com USRobotics V.90 WinModem**
Graphics	8MB AGP graphics nVidia Riva 128 ZX	8MB AGP graphics nVidia Riva 128 ZX	16MB Diamond Viper 550 TnT 2X AGP graphics	16MB Diamond Viper 550 TnT 2X AGP graphics	16MB Diamond Viper 550 TnT 2X AGP graphics
Sound System	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	PCI 128-voice Wavetable sound	PCI 128-voice Wavetable sound	Sound Blaster LIVE! Value audio card
Speakers	Advent AV690 speakers	Advent AV690 speakers	Advent AV690 speakers	Advent AV690 3-piece speaker system	Monsoon 3-piece THX-level speaker system
Warranty	5-year/3-year Micron Power Limited warranty 3-year Onsite warranty	5-year/3-year Micron Power Limited warranty 3-year Onsite warranty	5-year/3-year Micron Power Limited warranty 3-year Onsite warranty	5-year/3-year Micron Power Limited warranty 3-year Onsite warranty	5-year/3-year Micron Power Limited warranty 3-year Onsite warranty
Training	1-year free† training @ Micron U online	1-year free† training @ Micron U online	1-year free† training @ Micron U online	1-year free† training @ Micron U online	1-year free† training @ Micron U online
Software Included	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Free† Office 2000 upgrade Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Free† Office 2000 upgrade Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Free† Office 2000 upgrade Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Free† Office 2000 upgrade Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Free† Office 2000 upgrade Norton AntiVirus
Also Includes:	MicroTower™ case 104-key enhanced keyboard Microsoft IntelliMouse® 3.5" floppy drive 1-year EarthLink Sprint Internet Access	MiniTower case 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive 1-year EarthLink Sprint Internet Access	MiniTower case 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive 1-year EarthLink Sprint Internet Access	MiniTower case 104-key enhanced keyboard Logitech 3-button mouse 3.5" floppy drive 1-year EarthLink Sprint Internet Access	Additional storage: SuperDisk LS 120 MiniTower case 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive 1-year EarthLink Sprint Internet Access
Factory Direct Price	$1,397 $49/mo. Business Lease. 36 mos.-	$1,599 $56/mo. Business Lease. 36 mos.-	$2,389 $83/mo. Business Lease. 36 mos.	$2,399 $84/mo. Business Lease. 36 mos.	$3,299 $115/mo. Business Lease. 36 mos.-
Order Code:	50150	40151	40152	40157	40154
Upgrade to:	Upgrade to: 19" Micron 900Lx (18" display) monitor 4.8X max speed DVD-ROM drive***	Upgrade to: 17" Micron Trinitron (16" display) monitor 128MB SDRAM	Upgrade to: 19" Micron 900Lx (18" display) monitor SuperDisk LS 120	Upgrade to: 20GB Ultra ATA 66 hard drive* 19" Micron Trinitron (18" display) monitor	Upgrade to: 22GB Ultra ATA 66 hard drive* Sony CD R/RW Recordable/Rewritable
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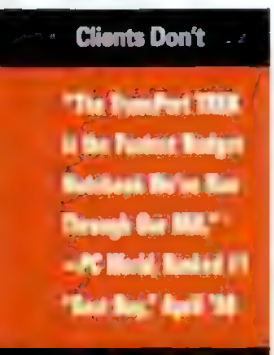

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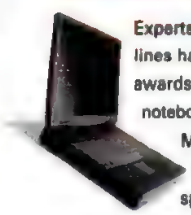

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intel inside
pentium II

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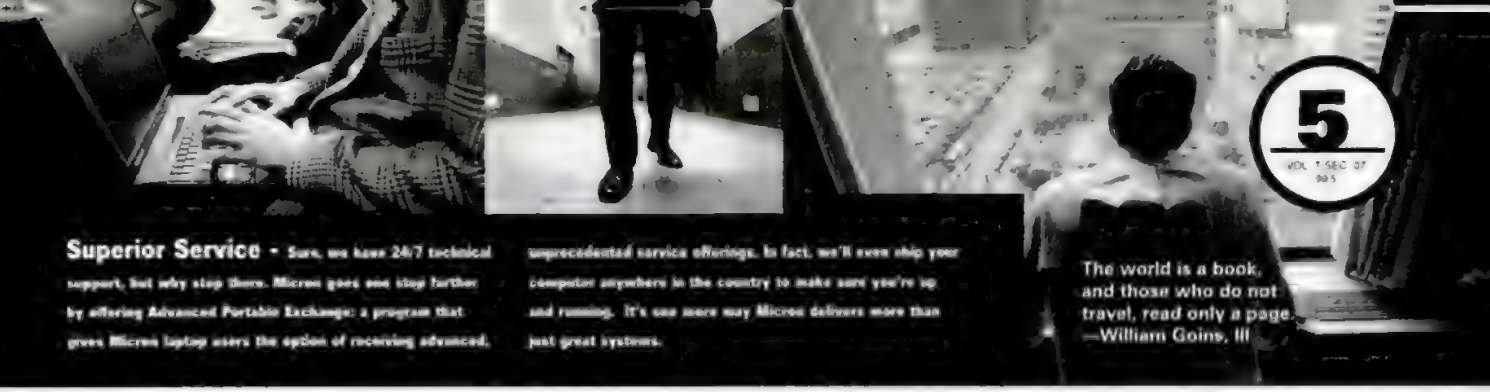

"First things first: we've got to acknowledge the fastest Pentium-class notebook that we have ever tested - TransPort TREK².™"

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366MHz Power Special

Model Name	TREK² 300	TREK² 300	New! TREK² 333	New! TREK² 366
Processor	Intel® Celeron™ processor 300MHz	Intel Pentium II processor 300PE MHz	Intel Pentium II processor 333MHz	Intel Pentium II processor 366MHz
Cache	128KB L2 pipeline burst cache	256KB L2 pipeline burst cache	256KB L2 pipeline burst cache	256KB L2 pipeline burst cache
RAM	32MB EDO DRAM	32MB SDRAM	64MB SDRAM	128MB SDRAM
Hard Drive	4.3GB hard drive (removable)+	4.3GB hard drive (removable)+	6GB hard drive (removable)+	10GB hard drive (removable)+
Monitor	12.1" SVGA TFT display	14.1" XGA TFT display	14.1" XGA TFT display	14.1" XGA TFT display
Extra Storage	3.5" floppy disk drive (dedicated bay)	3.5" floppy disk drive (dedicated bay)	3.5" floppy disk drive (dedicated bay)	3.5" floppy disk drive (dedicated bay)
CD-ROM	24X CD-ROM drive* (dedicated bay)	24X CD-ROM drive* (dedicated bay)	24X CD-ROM drive* (dedicated bay)	24X CD-ROM drive* (dedicated bay)
Graphics	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator
Sound System	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone
Warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty
Software Included	Microsoft Windows 98 System Wizard Mobile Client™* Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition Free* Upgrade to Microsoft Office 2000 System Wizard Mobile Client™* Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition Free* Upgrade to Microsoft Office 2000 System Wizard Mobile Client™* Norton AntiVirus	Microsoft Windows 98 System Wizard Mobile Client™* Norton AntiVirus
Training:	1-year free* training at Micron U online	1-year free* training at Micron U online	1-year free* training at Micron U online	1-year free* training at Micron U online
Also Includes:	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible Wavetable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible Wavetable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible Wavetable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible Wavetable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports
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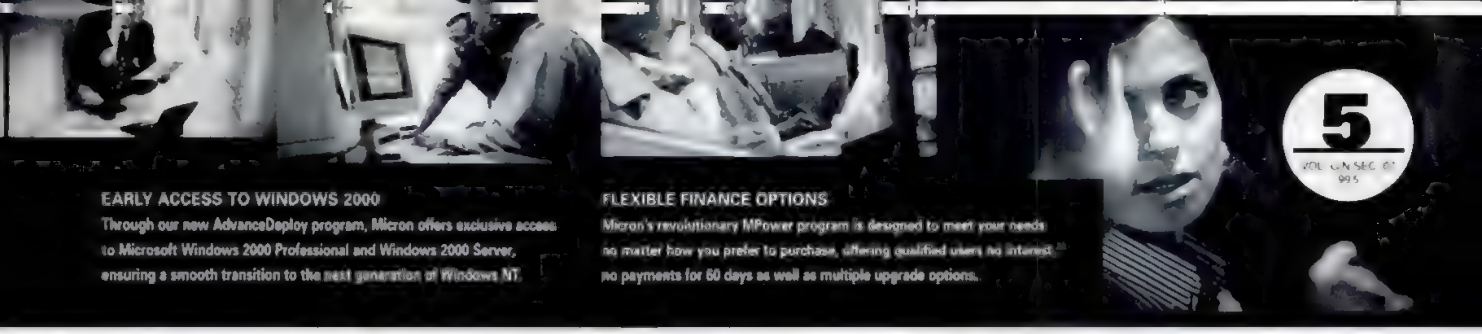

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- 17" Micron 700Vx (15.9" display)
- 40X max speed CD-ROM drive*
- 8MB nVidia Riva128ZX AGP graphics
- 64-voice PCI Wavetable sound
- 3Com 3C905 WOL 10/100 network card
- 3-year/3-year Micron Power™ limited warranty
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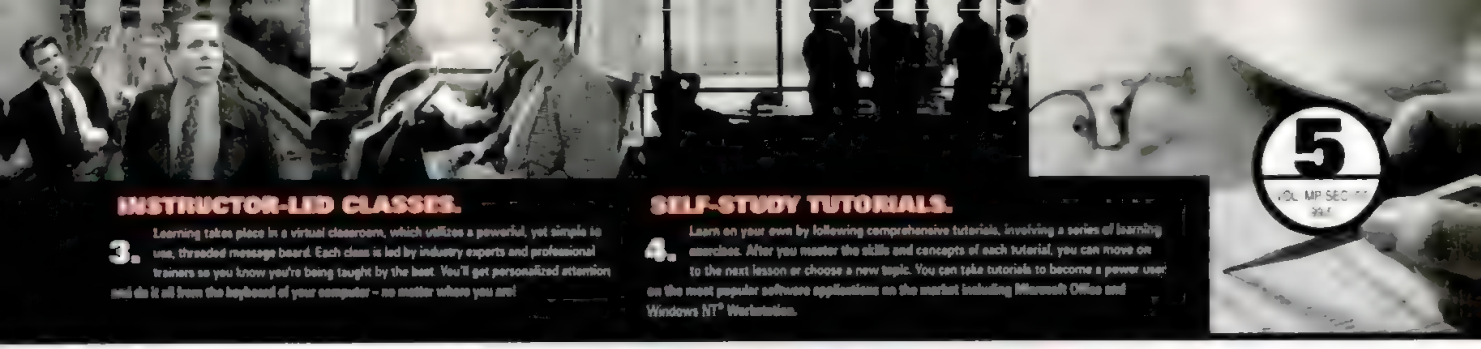

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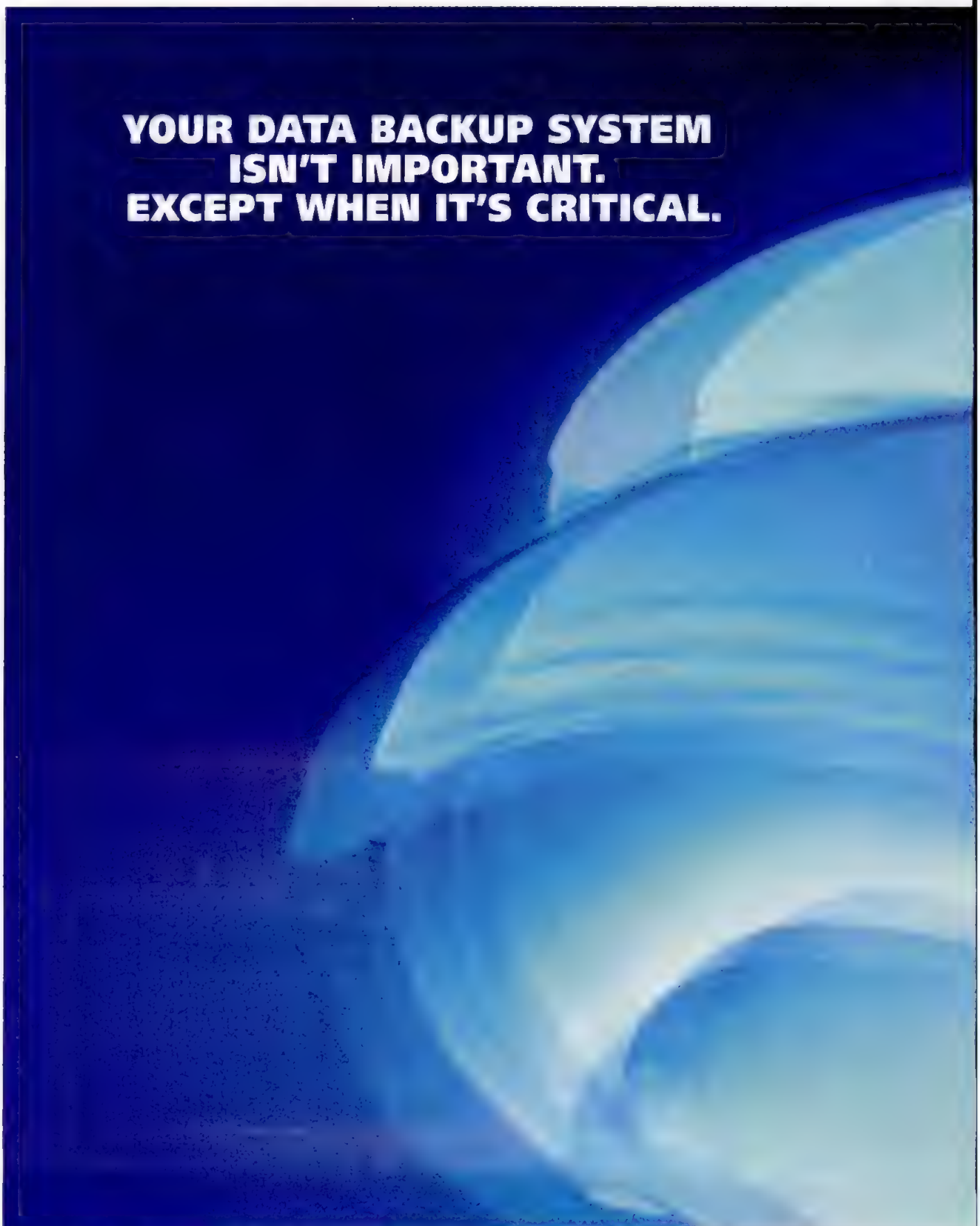

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Easy 3-D Modeling

Play's Amorphium delivers intuitive 3-D modeling tools, though its animation functionality is limited.

By Luisa Simone

Play Inc. has a habit of developing graphics products that redefine their markets. Snappy, for example, brings video capture to the average consumer's desktop, and Gizmos delivers sophisticated presentation software in the guise of a desktop accessory. With the first release of Amorphium, Play might make the same kinds of sweeping changes in the 3-D modeling arena.

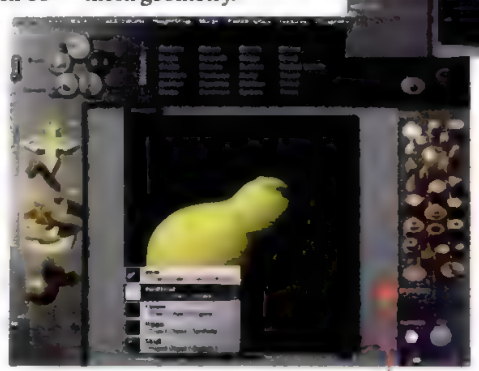
Though Amorphium is affordable ($150 street), the key to its broad appeal is its accessibility. The interface, for example, simplifies the 3-D modeling process by segregating each object into its own viewport. Even if you want to produce a complex scene, you must work on each object separately, tabbing between the different viewports.

The workspace is simplified in other ways. Navigation gizmos let you move or rotate an object easily. And you can't mess up the lighting, because an Amorphium scene contains only one light source. But Amorphium is truly a complete modeling program. Separate toolbars provide structured access to such high-end functions as bump maps (HeightShop), shape interpolation (Morph), and surface materials (Paint&Optics).

THIS YEAR'S MODEL

Many of Amorphium's modeling functions can be found in other 3-D modeling programs. For example, you can generate a 3-D terrain from a gray-scale image, in the manner of MetaCreations Bryce 3D. And you can build organic models by using BioSpheres, which attract and repel one another in the manner of Caligari's trueSpace's MetaBalls.

Several features distinguish Amorphium from the competition, however. First and foremost is AGE (Amorphium Graphics Engine). This incredibly fast rendering engine lets you manipulate objects in real time, even without hardware acceleration. On our 200-MHz Pentium test PC, Amorphium's screen updates were so responsive that we could reshape smooth, shaded objects without a pause and without thinking about the underlying mesh geometry.



PLIABLE: *3-D brushes, found along the right side of the workspace, let you sculpt objects as though you were working in clay.*

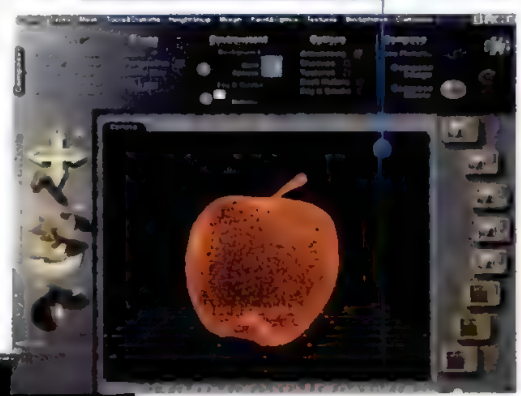
EASY-TO-USE TOOLS

Amorphium works very hard at hiding the mathematical underpinnings of 3-D modeling. Instead of grappling with NURB splines, vertices, and polygon counts, Amorphium employs real-world paradigms, such as sculpting clay or painting directly on the individual surfaces of an object.

The Tools&Distorts toolbar provides a palette of a few dozen 3-D brush shapes. By configuring the size of a brush and the amount of positive or negative pressure, you can literally push or pull the surface of a 3-D object.

We were especially impressed with the various brush modes. For example, Spheric Brush orients your brush strokes to the center of a round-

LIVELY: *Amorphium can produce simple movies containing a single animated object, with a maximum number of only eight keyframe placeholders.*



ed object, and Smooth Brush can correct misaligned vertices. The ability to affect geometry with brush strokes is especially powerful when you turn on symmetry or use the Paint Adaptive mode to increase or decrease the number of polygons in an object.

Play sees its primary audience for this program as 2-D artists making the transition to 3-D, so the company often borrows metaphors from 2-D image-editing programs. Instead of selecting vertices when you want to affect only a portion of a model, you use the Mask tools to protect those portions of the object you don't want to change. Masks work identically regardless of whether you are applying paint or modifying the geometry of an object.

THE DOWNSIDE

Amorphium offers only basic composition tools, along with animation functions that are disappointing. In Composer mode, all of the individual objects you have open in the workspace are automatically added to the scene. You can size and position objects here and then render the still image in one of a handful of formats, such as GIF, TIF, or PNG. But the program does not support true reflections or environment maps.

We also encountered a minor rendering glitch. Unless we first rendered a scene to the screen, exporting a still image produced a wireframe picture and not a fully shaded composition. In addition, we discovered that you can animate only one object in a scene, and each scene can contain only eight keyframes. The keyframes themselves are rather primitive, functioning more like snapshots than true keyframes.

These shortcomings, coupled with the fact that you can't preview an animation internally, make generating anything but the simplest animations difficult. We also wish that the movie output options (which include animated GIF, Intel Indeo, and motion JPEG) offered more control over compression.

Amorphium's animation functions take second place to the modeling tools. But the modeling tools—especially the sculpting functions—are really fun to use. With a little practice, both 3-D enthusiasts and 2-D artists can produce complex, realistic 3-D objects. And because Amorphium can import and export every major 3-D file format, such as LightWave LWO, 3D Studio 3DS, and Wavefront OBJ, we expect that this program will find its way to professional desktops.

Amorphium. Street price: $150. Requires: 32MB RAM, Windows 95, 98, or NT 4.0 or later. Play Inc., Cordova, CA; 800-306-7529; *www.play.com*.

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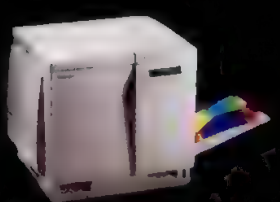

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Striking 3-D Graphics

The ATI Rage Fury graphics card has finally arrived—but is it too little, too late?

By Nick Stam

The wait has been long, but ATI's Rage Fury graphics card ($140 street), based on the Rage 128 accelerator, is finally here. This card is targeted primarily at high-end entertainment and gaming applications and secondarily at low-end OpenGL workstations. But though this card is indeed flexible, it faces serious challenges from competitors, particularly with 3-D.

CHIP SPECS

The Rage 128 chip comes in two flavors: the GL (tested for this review), which supports 32MB of memory with a 128-bit memory interface, and the VR, a lower-cost chip, which supports 16MB of memory with a 64-bit memory interface and is intended to be integrated on motherboards of mainstream PCs.

Both versions have a 128-bit 2-D/3-D graphics engine and support all functions of 2X AGP including texturing, pipelining, and sideband signaling. They use ATI's Twin Cache Architecture, which comprises an 8K texture cache plus an 8K pixel cache. The Rage 128 also supports single-pass multitexuring (or single-pass trilinear filtering), and various special effects including alpha blending, video textures, reflection maps, and bump mapping.

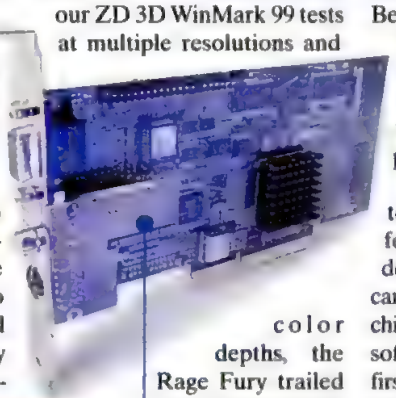
This product is also the first graphics chip with both DVD motion compensation and iDCT (inverse discrete cosine transform) support for DVD decode assistance. This feature allows for much lower CPU utilization when playing DVD movies.

The Rage Fury GL incorporates the Rage 128 GL chip and 32MB of SDRAM; it supercedes cards based on the company's Rage Pro Turbo chip. Beyond the 2-D, 3-D, and DVD features supported by the Rage 128 chip, the card integrates composite NTSC and S-Video–out jacks to connect to a TV, as well as the ATI Media Channel, which can be used to connect ATI's optional TV tuner and capture cards (including the new ATI TV Wonder).

The Rage Fury GL supports Windows 95, 98, and NT 4.0 (with Service Pack 3) and includes an OpenGL client driver. With 32MB of frame-buffer memory, the card also handles very high 2-D and 3-D resolutions and color depths. Its maximum rated 3-D setting is 1,920-by-1,200 at 32 bits per pixel, double-buffered, with a 32-bit Z-buffer.

TEST DRIVE

We tested on a 500-MHz Pentium III–based Dell Dimension XPS T500. Surprisingly, the Rage Fury GL wasn't as fast as the STB Velocity 4400 RIVA TNT using nVidia's new Detonator reference drivers (Version 1.09, available for download at *www.nvidia.com*). On our ZD 3D WinMark 99 tests at multiple resolutions and color depths, the Rage Fury trailed the Velocity 4400 card by as much as 20 percent.



HEADS UP, GAMERS: *The Rage Fury card is a great 2-D/3-D performer.*

We also compared the Rage Fury performance with that of a preproduction version of a Diamond Viper V770 card, based on nVidia's forthcoming TNT-2 Ultra chip, which was clocked at an incredibly high 175 MHz for the core and 200 MHz for memory; we tested it with nVidia's new Detonator driver, which is still in beta (Version 1.72). The Viper card's scores on our 3D WinMark tests were more than 70 percent higher than the Rage Fury's. On the Quake II Crusher multiplayer demo running at 1,024-by-768 32 bpp using OpenGL drivers, the Rage Fury outperformed the Velocity 4400 card but wasn't as fast as the Viper 770.

EXCELLENT VISUALS

The Rage Fury GL exhibited stunning 3-D visual quality. Game scenes were vivid, colorful, and artifact-free. We were unable to run our 3D WinBench quality tests with a 24-bit Z-buffer, though, and one of our texture-heavy scenes locked the system once, but we couldn't duplicate the problem.

On our DVD playback tests, we couldn't tell the difference between a top-notch dedicated hardware decoder card based on C-Cube's ZivaPC chip and the Rage Fury assisted-software DVD decoding—a first in our labs. On the ZD CPU Utilization test, we measured approximately 20 to 25 percent CPU usage while watching DVD movies on our test system.

If this review had been conducted four months ago, we would have been astounded by the Rage Fury; at this late date, you should also consider cards based on the upcoming Voodoo3, TNT-2, Savage4, and Permedia 3 chips. But if you want a great 2-D/3-D performer with excellent visual quality, TV connectivity, and built-in DVD decoding, you'll still get plenty of satisfaction out of the ATI Rage Fury.

ATI Rage Fury. Street price: $140. ATI Technologies Inc., Thornhill, Ontario, Canada; 905-882-2600; *www.atitech.com*.

PERFORMANCE TESTS

3-D Graphics Cards

16-bit 32-bit

High scores are best
Bold type denotes first place

	ZD 3D WinMark 99 1,024 x 768, 85 Hz		1,280 x 1,024, 85 Hz		1,600 x 1,200, 75 Hz		ZD Business Winstone 99 1,024 x 768, 85 Hz	Quake 3.20 Crusher fps
ATI Rage Fury (32MB)	619	482	411	297	286	195	24.1	27.3
Diamond Viper V770 (32MB)*	**1,050**	**779**	**807**	**466**	**514**	**310**	**24.3**	**38.5**
STB Velocity 4400 AGP (16MB)	776	511	464	N/A	[illegible]	N/A	23.9	23.1

BETTER ▶ BETTER ▶ BETTER ▶

N/A—Not supported. The card does not support the resolution at that color depth. * Preproduction review sample

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Three Ways to Network

New products from Entrega, Intel, and NDC use different technologies to simplify networking.

By Bruce Brown and Les Freed

If you want to connect PCs to share files, printers, and Internet-access devices such cable modems in your home or small office, you now have more ways to do this than ever before—thanks to advances in networking technologies. Though no single technology is best for all applications, the panoply of new network connection methods lets you select the best tool for your particular needs.

Three new choices for home and small business networking are the Entrega USBnet ($80 street), the Intel AnyPoint Home Network ($190 street), and the NDC SOHOware CableFree Starter Kit ($395 list). USBnet lets you connect two PCs via their USB ports. AnyPoint Home Network is a parallel-port home Phoneline connection solution for two or more PCs. And the CableFree system is the first 802.11-compliant product that's affordable enough for home or small-business use.

IT'S EASY: *The Entrega USBnet links two PCs via a small hub, with a simple status program for observing the connection.*

ENTREGA USBNET

If you want to hook up only two PCs for file and printer sharing, the Entrega USBnet, from Entrega Technologies, is an exceedingly simple way to connect via USB ports. Everything you need is in the package, including a nonpowered USB two-way hub, two 6-foot cables, and the required drivers and software. The tiny hub weighs 1.2 ounces and measures 0.8 by 1.8 by 2.5 inches (HWD).

Installing the USBnet took about 10 minutes, including reading the documentation and performing one system reboot on each of two PCs. To install a USBnet network, you plug one of the two cables into one PC, connect the cable to one side of the USB hub, install the USBnet software on the same PC, connect the second cable to the second PC and to the hub, and finally install the software on the second PC. A single LED on the hub glows red when one PC is connected and green when both PCs are networked.

You could use longer, standard USB cables with this kit to increase the distance between PCs. But to maintain performance and data integrity, it's best not to exceed the design specification, which means using the cables provided in the package.

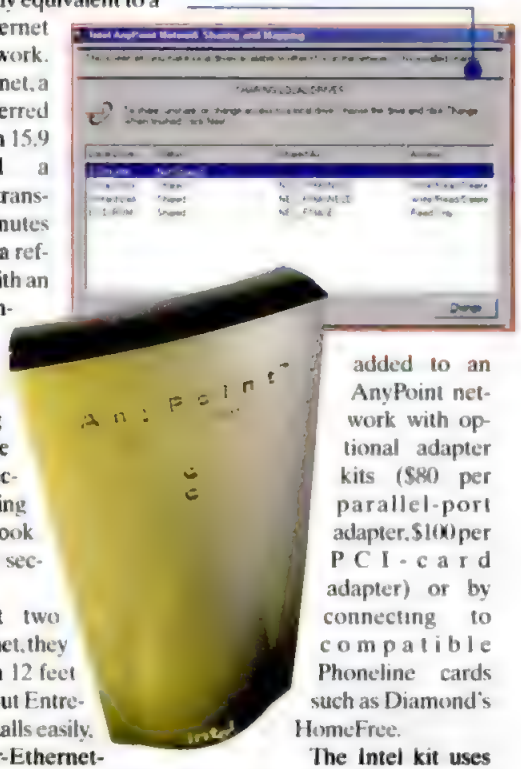
The manual included with the USBnet gives brief instructions for setting up file and printer sharing, both of which acted the same as with a conventional Windows peer-to-peer network. No software for sharing modems or Internet access is included. But since the network follows standard protocols and is viewable via Network Neighborhood, any software that works on a conventional peer-to-peer network should work with USBnet. The system recognizing a shared printer via the USBnet connection perfectly.

USB throughput is limited to 12 Mbps, roughly equivalent to a 10-Mbps Ethernet local area network. In testing USBnet, a 6MB file transferred between PCs in 15.9 seconds and a 295MB file transferred in 11 minutes 33 seconds. As a reference point, with an Ethernet connection between the same computers, transferring the smaller file took 14.6 seconds; transferring the larger file took 10 minutes 49 seconds.

To connect two PCs with USBnet, they must be within 12 feet of each other. But Entrega USBnet installs easily, provides near-Ethernet-level performance, and is economical, at just $40 per PC.

Entrega USBnet. Street price: $80. Requires: USB port, Windows 95 with USB support or Windows 98. Entrega Technologies Inc., Lake Forest, CA; 949-859-8866; *www.entrega.com*.

SHARED RESOURCES: *During installation, Intel's AnyPoint sets all system drives to Shared status by default, saving you from having to hassle with disk-sharing configurations.*



INTEL ANYPOINT HOME NETWORK

The Intel AnyPoint Home Network Starter Kit comes with all you need to connect two PCs, starting with two 7.9- by 3.6- by 3.6-inch (HWD) AnyPoint adapters, each with a pass-through parallel-port adapter. The package also includes two 3-foot parallel cables, two 9-foot telephone cables, two 6-foot power cables, and the AnyPoint software. More computers can be added to an AnyPoint network with optional adapter kits ($80 per parallel-port adapter, $100 per PCI-card adapter) or by connecting to compatible Phoneline cards such as Diamond's HomeFree.

The Intel kit uses the Home PNA Generation 1 standard, which provides for a maximum 1-Mbps connection. The advantage of Phoneline connectivity is that you can network PCs located anywhere in the same building where you have access to jacks from a single telephone line. Also, Phoneline technology lets you use a telephone line for networking without interfering with voice or modem connections. The AnyPoint also includes Internet-sharing software.

Installing the Intel AnyPoint Home Network on two PCs with a single shared printer and a shared Internet connection took roughly 20 minutes. The process went very smoothly and didn't require us to make any difficult network settings. Before installing software, you connect the AnyPoint adapters to each PC via parallel cable and plug in the power and Phoneline connections.

PHOTOGRAPHY BY THOMAS O'CONNOR

During installation, you're prompted to give each PC a unique name and to declare which is the client and which is the server. Otherwise, you can complete the entire process by simply clicking Next or Finish on a series of installation screens. The software shares all drives and printers in or attached to each PC by default, although you can choose not to share any or all devices.

To share Internet access with the client PC, the server PC must connect to the Internet. By default, each time you start the server PC, it automatically dials the Internet with the selected access software. At no time during installation do you need to go to the Control Panel Network Settings window or manually select and load network protocols or services.

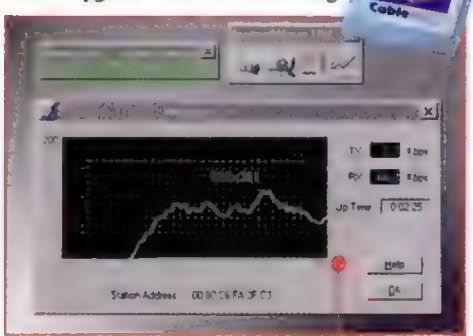
After the AnyPoint network has been installed, two LEDs on each adapter (which double as troubleshooting indicators) show local connection integrity and network activity. A handy reference to decipher the status lights is printed on the back of each adapter.

It took 69 seconds to copy a 6MB file between two PCs on the AnyPoint network and 55 minutes 19 seconds to transfer the 295MB test file. In absolute throughput, AnyPoint is, as expected, slower than either Ethernet or USBnet. For more typical home use, however, such as playing network games, the throughput rate should be sufficient.

The advantage of Phoneline networking is that you don't need to add new wires to your home. The Intel AnyPoint Home Network doesn't even require that you open your PC, letting you connect via parallel port for quick configuration with a particularly smooth setup process. **Intel AnyPoint Home Network.** Street price: $190. Requires: 8MB RAM, 18MB hard disk space, parallel-port connector, Windows 95 or 98,. Intel Corp., Santa Clara, CA; 877-649-5817; *www.intel.com*.

NDC SOHOWARE CABLEFREE STARTER KIT

The NDC SOHOware CableFree Starter Kit brings standards-based IEEE 802.11 wireless networking to the home and small-office markets at a reasonable price. NDC Communications offers two different CableFree kits ($395 list, each), one with two ISA cards and the other with one ISA and one PC Card. Both kits include Sygate's Internet-sharing software. We tested the ISA and PC Card kit along with the CableFree Ethernet bridge ($395 list), which lets you connect up to 16 wireless PCs to an existing Ethernet LAN.



REAL TIME: *The CableFree system's software interface makes monitoring vital network statistics easy.*

At first glance, $200 per PC seems a steep price for a network kit, especially for one that runs only at 2 Mbps. But if the physical locations of your PCs makes it difficult or impossible to run Ethernet cable between them, $200 per PC starts to look pretty good. Radio-based wireless systems can easily span several floors in a multistory building, making them ideal for large homes, college dorms, or apartment buildings.

We had no problems installing either the ISA or PC Card CableFree adapters. Both cards install in your PC as a network adapter, and they make use of Windows' built-in file and printer-sharing features. The ISA card includes an external antenna with 4 feet of very thin cable. The antenna should be mounted as high as possible for best results, but we found the cable was just a little short for under-the-desk PC installations. The PC Card's antenna is a flat plastic piece that sticks out of the PC Card slot when installed. Both of the cards have link and activity LEDs.

On our informal tests, the CableFree system managed about 1.6-Mbps throughput. Our test system also easily exceeded NDC's claimed range of 250 feet between units.

The Ethernet bridge is also easy to install. You simply plug it into your existing 10-Mbps Ethernet hub, and it establishes a connection between your LAN and up to 16 wireless computers. The EtherBridge has two antennas that help eliminate dead spots in coverage area, and it has five status LEDs.

NDC Communications plans to release PCI card and external USB CableFree products later this year. The USB version is especially appealing, since—as with the PC Card—it will allow users to connect their PCs to the LAN without opening their cases.

NDC SOHOware CableFree Starter Kit. List price: $395; CableFree EtherBridge, $395. NDC Communications, Sunnyvale, CA; 800-632-1118; *www.ndclan.com*.

PC MAGAZINE EDITORS' HOT LINKS

www.pcmag.com/hotlinks

The following are some Web sites that can give you lots of information and assistance in setting up a home or small-office network:

➤ZDNet
www.zdnet.com/products/stories/reviews/0,4161,2226069,00.html
Look here for *PC Magazine*'s most recent complete survey of home networking products.

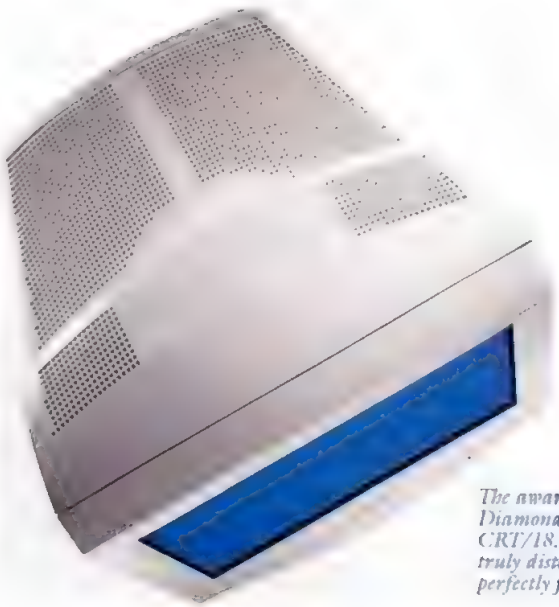
➤The Home Automation Association
www.homeautomation.org
Go to this site for inspiration and information about the potentials and realities of automating your home.

➤Home Phoneline Networking Alliance
www.homepna.org
This is the site of the Home Phoneline Networking Alliance, the group that promotes networking using regular telephone lines in homes.

➤HomeRF
www.homerf.org
The Home Radio Frequency group promotes and supports wireless networking in homes.

➤USB
www.usb.org
For information and links regarding USB technology, peripherals, and networking, go to this useful and instructional source.

Has Your Monitor Been



The award-winning Diamond Pro 900u (19-inch CRT/18.0-inch DVI) is truly distortion-free with a perfectly flat screen surface.*

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PC Magazine — Diamond Pro 900u Jan 19, 1999

PC Magazine — Diamond Pro 900u Best 19" upgrade March 9 1999

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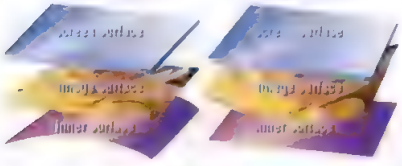
If you're using a conventional CRT monitor, your eyes and brain are working overtime to correct for the curvature. Now, however, with its DIAMONDTRON NF™ (Natural Flat) family, Mitsubishi has completely revolutionized monitor technology. With a perfectly flat screen from edge to edge and truly distortion-free imagery, you'll experience an unprecedented improvement in viewing pleasure. Not to mention the dazzling brightness, razor-sharp clarity and stunning color accuracy which puts Mitsubishi in a class by itself. With no curvature, reflections and glare are also eliminated. The result is remarkably realistic, natural-looking flat images. Your energy can now be spent being more creative and more productive. For added versatility, DIAMONDTRON NF monitors feature a unique self-powered USB hub which allows you to switch all connected USB peripherals between two computers automatically. With DIAMONDTRON NF monitors, Mitsubishi will forever change your view of the world. The difference is right before your eyes. For more information on the award-winning Diamond Pro 900u (19-inch CRT/18.0-inch DVI*) and new Diamond Pro 2020u (22-inch CRT/20-inch DVI*) models, contact Mitsubishi Electronics today.

DIAMONDTRON NF



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Trading Like a Pro

Omega Research's ProSuite 2000i helps you decide which securities to buy and when to buy and sell.

By Sal Ricciardi

Successful traders have a knack for knowing when to buy and sell. But it's not always the result of an advanced analytical mind. Products like Omega Research's ProSuite 2000i ($4,799 list or $299.95 per month for 16 months) help the pros keep their edge.

ProSuite combines three of Omega's tools for serious investors. The first, TradeStation 2000i, lets you design, test, and optimize sophisticated trading systems that apply technical analysis to market data. The second, OptionStation 2000i, supplies tools to produce a profitable options-investing strategy based on your market assumptions. Finally, RadarScreen 2000i lets you automatically sift through the markets to highlight trading opportunities that meet your criteria.

ANALYZE THIS: *TradeStation 2000i lets you apply custom technical analysis techniques*

ANALYZING THE MARKET

TradeStation 2000i, the heart of the suite, offers a graduated approach to technical analysis of the markets, where your goal is to profit by quickly identifying trend changes. You start by charting a security's historical performance. Then you apply any of TradeStation's library of technical indicators, which are measures used to identify trending behavior.

For example, you can apply the moving average and relative strength indicators to a chart and draw inferences from their results—provided that you understand how to interpret the indicators. We were impressed with the depth of the indicator library and with the product's Expert Commentary feature, which provides you with the conventional interpretation for any indicator applied to a chart, a helpful aid for those learning technical analysis.

Next, you can apply studies to a chart. Studies plot information differently than indicators by painting or marking individual bars on a chart, for example. After mastering studies, you go on to TradeStation's biggest strength: building and testing full-blown trading systems.

Trading systems generate buy and sell orders based on entry and exit criteria that you define using the built-in signals available through the SystemBuilder or by writing your own using Omega's EasyLanguage, a Basiclike definition language common to all three products. You can back-test systems to see which ones work best and then optimize them.

What distinguishes ProSuite is that it gives you the opportunity to customize nearly every application of technical analysis performed within it, in graduated fashion. For instance, you can tune built-in indicators by modifying their input variables or by altering their EasyLanguage source code. If that doesn't suffice, you can write your own custom indicator from scratch.

ON THE RADAR

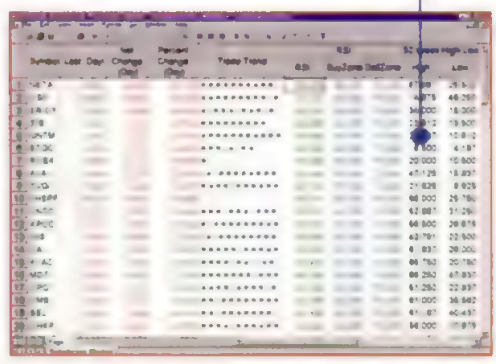
Options traders will be pleased with OptionStation. Options require a discipline and level of expertise equal to their high level of risk and potential reward. OptionStation automates what would otherwise be a boondoggle of complex calculations and lets you analyze and select those option strategies that would prove most profitable should your market outlook come to pass.

The product uses a spreadsheetlike interface to display the 50 best strategies calculated within your guidelines, including how many of each specific option contract to buy. You can calculate theoretical maximum profit and loss and monitor your positions on an ongoing basis.

RadarScreen 2000i lets you scan the markets in real time and search for those trading opportunities that match your criteria. Its interface lets you easily insert technical indicator columns from the built-in library, or you can insert your own custom-written additions.

You can use sector templates to pull in symbols by business sector and dynamically sort the list on any column on a real-time, tick-by-tick basis. Position monitoring lets you track your own portfolio's profitability, and you can create multiple views for organizing different scenarios. The product makes sifting through large numbers of securities point-and-click easy.

PROSPECTING: *RadarScreen 2000i lets you scan the markets for trading opportunities.*



TEST DRIVE

All three programs support real-time, delayed, and end-of-day data feeds and provide for alert notification via pop-up window, e-mail, pager, or the tracking window. And all let you right-click to link to the Internet for research on the current symbol or to place a trade.

We tested ProSuite using the HyperFeed 2000 real-time data feed from PC Quote, which worked very well. We were less impressed with Omega Research's Historybank.com daily download service, which forces you to download an exchange's worth of data instead of just the data for the symbols you need.

If you're not familiar with earlier releases, you'll find ProSuite's daunting to learn. Testing resulted in some unresolved instability issues that should be addressed by the time you read this. The product comes with three manuals and substantial online help, but we think a whole bookshelf of printed documentation ought to be provided with a complex product that costs $4,799.

That said, the Omega Reserach ProSuite 2000i offers perhaps the most advanced support available for developing, testing, and implementing trading systems and technical analysis of the markets.

Omega Research ProSuite 2000i. List price: $4,799 or $299.95 per month for 16 months. Requires: Pentium II with 128MB RAM recommended; Windows 95, 98 or NT 4.0 with Service Pack 3 or later. Omega Research Inc., Miami; 800-422-8587; *www.omegaresearch.com.*

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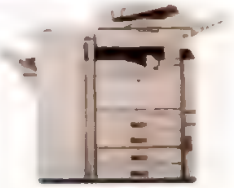

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The Computer Inside.™

From Paper to Page Web

Make browser-viewable versions of paper documents quickly and easily with OmniPage Web.

By Alfred Poor

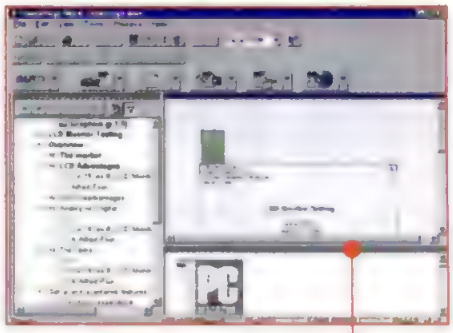
The Web is the gold rush of the 1990s, and the alchemists at Caere Corp. have made it easy to transmute your paper documents into Web gold. The company's new OmniPage Web ($500 street) can save your business thousands of dollars in development time.

Simply put, OmniPage Web takes paper documents (or stored images) and converts them into HTML code. Not only does it embed the HTML tags that make viewing documents with a browser possible, the program also performs sophisticated tasks that would take hours to code by hand.

For example, OmniPage Web uses the same powerful OCR engine as Caere's OmniPage Pro 9.0, which lets you convert scanned pages into text with speed and accuracy. The program can also recognize the structure of the document and can automatically create an outline with multilevel headings.

You can quickly change the heading assignments on screen if you disagree with the product's analysis, and OmniPage Web can then create multiple, linked HTML pages that break on the heading levels that you choose. Also, the converted pages are displayed with the outline in a frame adjacent to the text window—much like an Adobe Acrobat Reader display—making it easy for the reader to jump to any topic of interest quickly.

This alone would probably justify buying the package for many users, but there's more. If you have graphics in your original document, OmniPage Web will capture the images—in color if you want—and place them in their correct positions on the Web page. The program also supports Cascading Style Sheets (CSS).



WEB-READY: *OmniPage Web provides a wizard and other quick access buttons for converting paper documents into Web pages*

OmniPage Web automatically identifies and leaves out headers and footers from paper documents; you can specify your own headers and footers to appear on the Web pages. A range of attractive templates provides color backgrounds and formatting to your converted documents.

OmniPage Web is not a Web site generator, though; the software simply creates a series of linked HTML pages that you can then post on a Web site or make available for viewing with a standard browser. OmniPage Web is also not an HTML editor, though you have complete access to the code it generates.

OmniPage Web lets you create attractive and useful HTML versions of paper documents, whether you post them on a Web or intranet site or simply copy them to a disk or CD.

OmniPage Web. Street price: $500. Caere Corp., Los Gatos, CA; 800-736-5735; *www.caere.com.*

Natural-Born Organizer

Dragon NaturallyOrganized combines synchronization with recording and voice recognition.

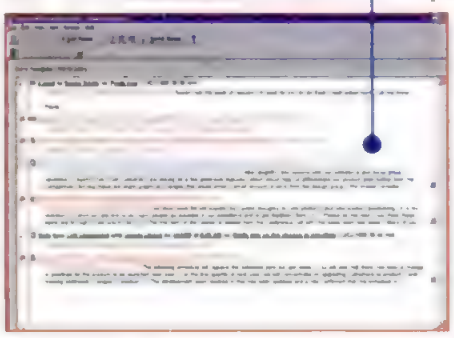
By Richard Fisco

Mobile recorders and voice recognition have been around for quite a while, but Dragon Systems was the first vendor to combine the technologies, in its NaturallySpeaking voice recognition software and the NaturallyMobile recorder (First Looks, December 15, 1998). Now, the Dragon NaturallyOrganized package ($399 list) merges NaturallySpeaking Preferred (an Editors' Choice–winning speech recognition application) and the NaturallyMobile recorder with its new NaturallyOrganized software.

The package includes everything you need to make voice recordings, turn them into text, and link the results with a desktop organizer. This version works only with ACT! 4.0, but future versions will work with GoldMine, Lotus Notes, and Microsoft Outlook.

You use the recorder to save digital voice files, specifying what kind of text you are creating: an e-mail, text files, a meeting, or a task. For example, you state "Schedule a meeting with..." or "Create a task" when you begin. Your speech appears in the edit box with the proper task heading. You then hook up the recorder to your PC using the included serial cable.

TAKE A MEMO: *Dragon NaturallyOrganized sorts your recorded tasks by the proper heading*



If you're accustomed to autosync, you'll be disappointed. You must launch the NaturallyOrganized software on your PC and upload the recorded files. Then the software, running in the background, performs the voice-to-text translation.

A review window appears to let you edit the text, which you then send to your ACT! database. As long as the name of the person you are sending e-mail to or inviting to a meeting is in your ACT! database, the NaturallyOrganized software will do the rest.

To set up Dragon NaturallySpeaking, you first load the software on your PC, then train it to understand your speech patterns. On a Pentium II/300 with 64MB of RAM, the entire process took about 1 hour and 10 minutes.

The product's promise of keeping you completely organized is enticing, but usability falls a bit short. The NaturallySpeaking software recognizes words with accuracy but not perfectly. As you use it, though, the software learns your speech patterns and accuracy increases.

Altogether, casual users of ACT! won't find this product very useful. But if your job depends on your contacts, spending time to train and use NaturallyOrganized properly could be well worth the effort.

Dragon NaturallyOrganized. List price: $399. Requires: 64MB RAM (96MB for Windows NT), 180MB hard disk space, Windows 95, 98, or NT. Dragon Systems Inc., Newton, MA; 800-825-5897; *www.dragonsys.com.*

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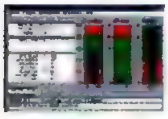
Back-UPS Pro® Power User Features



- PowerChute® *plus* power management software automatically saves data, closes programs, and shuts down your computer.
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- "Your PC's data is your life. Don't take any chances. The Back-UPS Pro 650 gives you 650VA protection and the longest battery life of any UPS we tested." *- PC Computing*
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DV Capture Grows Up

The Canopus DV Raptor video capture card delivers inventive design and unrivaled performance.

By Jan Ozer

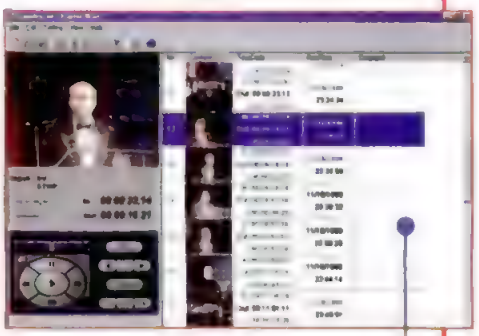
Though sub-$1,000 DV capture cards have been around for a while, each had rough edges, such as feature deficits or unstable operation. The DV Raptor ($649 list), from Canopus Corp., ends all that, combining an innovative hardware design, highly functional applets, great performance, and unparalleled Adobe Premiere integration into a product ideal for virtually any DV or DVCAM developer.

Canopus ships the Raptor with a full version of MediaStudio Pro 5.2 and drivers for Adobe Premiere 5.1. The Raptor's PCI-based hardware accepts S-Video or composite input to provide real-time preview on your PC's monitor as well as NTSC output.

Though the Raptor ships with MediaStudio, the card is actually better integrated with Premiere. You can capture or batch-capture within Premiere with machine control; compile your video on the timeline with titles, transitions, and special effects; and then write the clip back to tape without rendering first. The Raptor builds all necessary temporary files and then smoothly writes the finished movie to your camera, avoiding Windows' 2GB file limitation.

We tested the Raptor on a 350-MHz Pentium II PC running Windows 95 with 128MB of RAM, capturing to and editing from a Medea VideoRaid PCI drive. Operation within Premiere was snappy, with prompt screen updates; a 3-second cross-dissolve took 31 seconds, which is fast enough for most applications.

The Raptor ships with two functional applets, Navi and Video. Navi scans your DV tapes and breaks them out into scenes, listing them with time code and duration information, origination date and time, a snapshot of the first frame, and room for a comment. You can delete and change the order of clips and create an RNL file that you can batch-capture within Raptor Video.



TAPE SCAN: *Raptor Navi logs your tapes for you, breaking your tape into scenes and saving valuable production time.*

Raptor Video also has full manual capture capabilities. You can load multiple files into Raptor Video, creating a play list that the program will write back sequentially to your DV camera—a useful complement to the Raptor's timeline-editing capabilities.

Our only complaint was that the Raptor's applications are slightly underdocumented and lack online help. This is easy to overlook, given the Raptor's otherwise exceptional capabilities.

Canopus DV Raptor. List price: $649. Requires: 64MB RAM, AV-rated hard disk, Windows 95, 98, or NT 4.0. Canopus Corp., San Jose, CA; 408-954-4500; *www.canopuscorp.com.*

Virtual Bird Brain

Mindmaker's Prody Parrot desktop assistant is as useful as it is entertaining.

By Bruce and Marge Brown

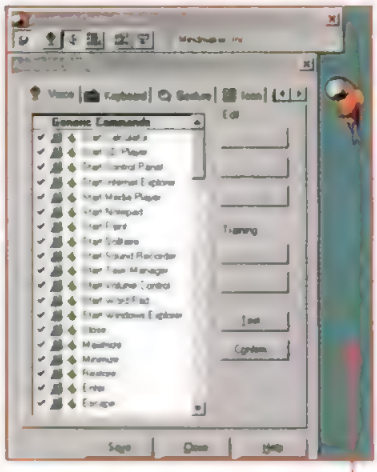
Not everyone wants a virtual companion. But for those who do, Mindmaker's Prody Parrot 2.0 ($100 street) is an intelligent assistant program that is both amusing and functional.

The user interface is in the form of a virtual bird with an attitude, Prody Parrot. It flies around the screen, chatters and complains, responds to commands to navigate Windows applications, monitors schedules, processes Internet-based phone calls, and connects to the Internet to provide e-mail, stock, weather, and sports reports.

You can interact with Prody Parrot via speech, due to its integrated speech-recognition technology, licensed from Lernout & Hauspie Speech Products. Prody is programmed to recognize such English voice and keyboard commands as "Minimize" and "Start Paint." We were surprised and pleased at how quickly we could start working with the software.

You can train the system to recognize new words or phrases, keyboard input, mouse gestures, or icons to execute commands. For example, you can draw the letter N with the mouse to open Notepad. With the Text-Assist command, you can have open documents read aloud.

Prody Parrot's Scheduler accepts imported appointments and tasks but not contact data from Microsoft Outlook. The program provides verbal reminders, but the lack of contact information makes Scheduler only marginally useful.



ANIMAL ACT: *You can train Prody Parrot to respond to voice, keyboard, mouse-gesture, and icon commands*

Prody Parrot can check POP3- or MAPI-compliant e-mail systems periodically and report on messages with a song, an icon, or Prody Parrot's voice. An additional feature lets you communicate via Internet telephony with other users.

If you need to take a break, try the amusing entertainment features. Prody Parrot likes to be petted (with the cursor) and fed (with icon food), and speaks up if he feels ignored. You can adjust Prody's level of interaction, select and edit his voice, play simple games, listen to his songs and (bad) jokes, take quizzes, or tell him to sleep. The program also includes Dr. Sbaitso, an interactive virtual psychiatrist with which you can converse, complete with wise-guy comments from the parrot.

Prody Parrot is a responsive conversational computer interface that works out of the box. The navigation tools are more useful for inexperienced users, but the Internet links can increase productivity for anyone.

Prody Parrot 2.0. Street price: $100. Requires: 32MB RAM, 65MB hard disk space, Windows 95, 98, NT 4.0, or later. Mindmaker Inc., San Jose, CA; 877-277-4786; *www.mindmaker.com.*

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PC/Computing
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PC Week Best of Show, *COMDEX/Fall 1998*

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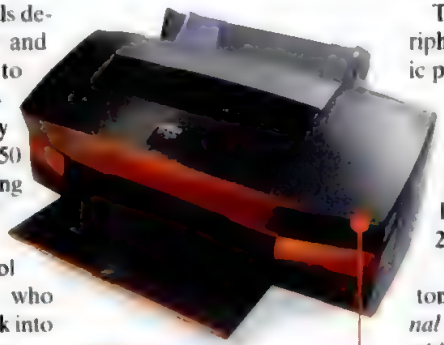
Photo Finishes

Two new products from Epson and HP aid both digital and film photographers.

Two new peripherals deliver high quality and greater usability to both digital and film photographers. The snazzy Epson Stylus Photo 750 brings home photo printing to a new level, and the HP PhotoSmart S20 Photo Scanner is an essential tool for film photographers who need to translate their work into high-quality digital images.



SLEEK: *The 750 has an updated case in a stylish dark-gray.*

EPSON STYLUS PHOTO 750

By Bruce and Marge Brown

The new Epson Stylus Photo 750 ($300 street) is a photocentric printer that's also fine for regular text and color graphics printing. Rated 50 percent faster than the Epson Stylus Photo 700, the 750 adds USB connectivity to the previous model's parallel and Macintosh serial ports.

Like the 700, the 750 prints at a maximum resolution of 1,440-by-720, but the drop size has decreased: It's now 6 picoliters, down from 11. Smaller drops enable finer detail and smoother images.

In addition to standard image-quality, paper-type, color, and speed settings, you can choose custom project types such as digital images and text with graphs. The driver also has settings for image reduction, enlarging, and collating.

The 750 printed gorgeous color photographic images on high-quality paper, as well as sharp text. In speed testing, a 4.5-by 7-inch color photo printed using PhotoShop LE 4.0 in 3 minutes 35 seconds on photo paper, in the highest resolution. A one-page Microsoft Word text sample printed in 43 seconds, and a 25-page document took 12 minutes 58 seconds. Though certainly not as fast with normal print jobs as a standard printer, the 750 is fine for low-volume duty.

The printer measures 11 by 16.6 by 22 inches (HWD) with all trays extended. The paper feeder holds up to 100 sheets or 10 envelopes of standard sizes or eight custom sizes. The 750's software bundle includes Epson's Digital PhotoLab with photo products and Web links references, Polaroid's PhotoMax Pro image editor, DogByte's Greeting Card Store SE, and ArcSoft's PhotoBase and PhotoPrinter.

The Epson Stylus Photo 750 delivers good value, a USB interface, and finer and faster printing.

Epson Stylus Photo 750. Street price: $300. Requires: 16MB RAM (32MB recommended for Windows 95 or 98, 64MB recommended for Windows NT 4.0), 50MB hard disk space. Epson America Inc., Torrance, CA; 800-463-7766; *www.epson.com.*

HP PHOTOSMART S20 PHOTO SCANNER

By Daniel Grotta and Sally Wiener Grotta

For nonprofessional photographers who haven't yet gone digital, the Hewlett-Packard PhotoSmart S20 Photo Scanner ($500 street) is an affordable, easy-to-use device for getting images into your computer. Despite a few minor quirks, the S20 delivers excellent quality.

The S20 is a shoebox-size peripheral that scans photographic prints (up to 5 by 7 inches), both negative and positive strips, and mounted 35-mm slides, even in panoramic mode. It has an optical resolution of 300 ppi (print) and 2,400 ppi (film).

There's a photo format button for selecting the *type original* (the material to be copied), which moves the mirrors and *gill* (media frame) to the appropriate positions. There's no on/off switch: The S20 draws almost no power when it's not being used.

Installation was trouble-free, helped by well-written documentation. HP provides two interfaces, one standalone and the other a Twain driver. In a program such as Photoshop, the Twain interface can scan 36-bit colors and save in 48-bit (interpolated) color. But the S20's bundled image-editing program, Microsoft Picture It! 99, can save only in 24-bit color.

Getting started can be frustrating. There's no click to begin a prescan; you choose the type original and feed it into the scanner and then wait for the pick-up motor to reel it in. But if you don't push the type original in far enough, this won't work.

Also, since there are no adjustable paper guides, snapshots can skew while being fed into the scanner. But the interface has a tool for rotating images in 1-degree as well as 90-degree increments.

You can automatically prescan up to five images on a 35-mm strip. Once prescanned, thumbnails are displayed on the interface. Clicking on a magnifier icon opens a variety of sophisticated and simple-to-use sliders and tools for adjusting exposure, color, rotation, size, and sharpness.

PREVIEW: *The S20 lets you adjust image quality before scanning.*

VERSATILE: *You can scan photos, filmstrips, and slides in the S20.*

In standalone mode, each scanned image is saved directly to the hard disk, using an automatic incremented number. Unfortunately, resetting or customizing filenames is not possible. The S20 saves in BMP, FlashPix, JPEG, and TIFF formats.

The S20 delivers impressive image quality. Colors are bright and realistic without being oversaturated. Edges are well defined. We saw little noise, mechanically related artifacts, or pixelization, even when images were scaled up to 200 percent.

The PhotoSmart S20's versatility makes it a must-buy for anyone still wedded to film.

HP PhotoSmart S20 Photo Scanner. Street price: $500. Hewlett-Packard Co., Palo Alto, CA; 888-474-3867; *www.photosmart.com.*

PHOTOGRAPHY BY THOM O'CONNOR

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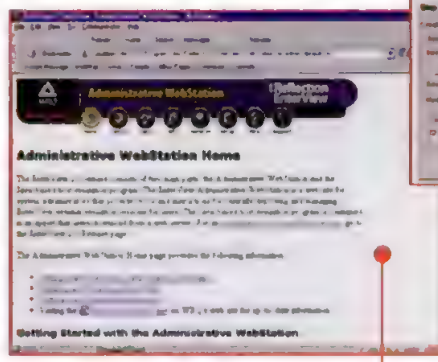
Web-Link Your Network

Java-based Reflection EnterView 2.0 gives networks complete Web-to-host access.

By Steve Rigney

Just because you don't have a big iron box in your wiring closet doesn't mean that you don't occasionally need to connect to a mainframe, midrange, or other host computer. Older solutions required you to use special terminal emulation software running on your network client to connect directly to the host computer backbone. Newer solutions, such as Reflection EnterView 2.0 ($135 list), from WRQ, let you connect to any host using a standard browser and an IP network, such as the Internet.

EnterView is completely Java-based and has browser-based terminals for almost any host system, including AS/400, IBM mainframe, Unix, and VAX systems. EnterView is also one of the few products on the market to include Transport Layer Security and encryption for your host connections.



STEP-BY-STEP: *The WebStation home page includes instructions for configuring your terminal emulation sessions.*

The EnterView package includes two main components—Administrative WebStation and Terminal Emulation. Both of these components are pure Java and HTML-based applications that will work with most popular browsers and HTTP Web servers.

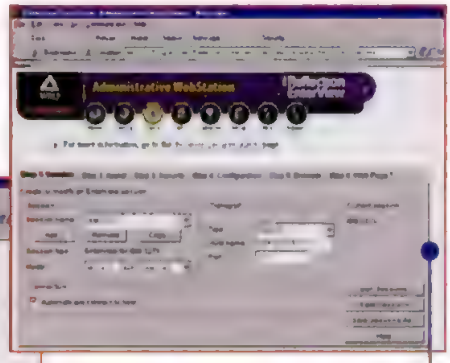
Like IBM's Host On-Demand, EnterView is one of a few products that provide a direct connection to the host from the client, meaning the client browser connects to the host without going through a proprietary gateway server. The client browser running EnterView also uses standard IP applications, such as telnet, to let you connect to any host via the Internet. The only requirement is that the host must have an SNA-to-IP gateway or must be directly running IP services.

INSTALLING ENTERVIEW

We found EnterView fairly easy to install, but you'll need to read the online manual to determine which components to install on the server and which on the client administration PC. There is no main installation menu that lets you install the WebStation pages and the terminal applets to their correct locations. You have to run each installation separately on the server or client that you want to use.

WebStation is a collection of HTML and Java code that lets you configure the terminal sessions. The Java-designed menus configure settings such as type of host, host name, keyboard layout, and even the size of the screen. If you want to go further and change the colors or the layout of the host screen (a process called *rejuvenation*), you'll have to write your own Java applets to plug into the EnterView Java APIs. After the sessions are created, they're stored on a Web server along with the terminal emulation components.

We especially liked the Deployment Director Java applet within WebStation. Though it is not a wizard, it uses numbered menus to guide you through each task. Deployment Director even created the basic HTML code we needed for each of our sessions. Advanced users can bypass this applet and use an HTML editor to create their own sessions and to point to specific terminal emulation applets.



CONFIGURE BY NUMBERS: *The Deployment Director makes sure you complete all of the configuration tasks in order.*

MAKING YOUR CONNECTION

After we created our test sessions and stored them on our IIS server, we were able to connect to the host by opening those pages on the server. The applet and session information is usually kept on the Web server, but you can also copy it to your local hard disk. We were also able to run all of the available terminal sessions using the EnterView CD. Because each session runs as a simple HTML page, you can open as many sessions, to single or multiple hosts, as you choose.

The direct-connection model doesn't require a dedicated server, but accessing a host through a corporate firewall is more difficult with this model. To solve this problem, WRQ includes a proxy server with the EnterView package. The proxy-server software can run on a PC running a JDK 1.1–compliant VM. In a nutshell, it lets remote clients pass safely through the firewall, authenticate on the proxy, and then access the host computer. Coupled with 56-bit DES and 168-bit triple DES encryption, this makes EnterView one of the more secure Web-to-host solutions.

REGULATING USAGE

In addition to WebStation, terminal emulation components, and the secure proxy server, EnterView includes a usage-metering utility. This applet runs on a server and keeps track of general client EnterView usage.

We also used the metering tool to block host connections when the license limit was exceeded and to limit the number of host connections based on user. You can choose to enable metering or even require it before a client would be able to establish a host connection.

WEB TERMINAL: *The terminal emulation sessions run under a browser but retain the look of a standard host connection.*

Corporate branch offices that need to access a remote host via a dial-up or leased-line connection (or any network that needs to connect to a host computer) will find Reflection EnterView 2.0 a secure and flexible tool. **Reflection EnterView 2.0.** List price: $135 per seat. WRQ, Seattle; 800-872-2829; *www.wrq.com.*

A Low-Cost Router, Plus

The ATronics IA2000 delivers easy Web-connection sharing and VMBOX, a virtual e-mail server.

By Steve Rigney

The slew of low-cost analog and ISDN routers on the market has made sharing a single Internet connection extremely easy and popular for SOHO users. These turnkey routers usually cost less than $1,000 and are so simple to configure that even novice users can set one up in minutes. But the number of these products now on the market makes a buying decision difficult.

A unique low-cost router is the ATronics Internet Access 2000 (IA2000). In addition to letting up to 250 users share a single dial-up ISP account, the IA2000's Virtual Mailbox (VMBOX) is a complete SMTP/POP3 e-mail server for both local and Internet-based messaging.

The IA2000 is designed especially for small LANs, and so is its list price of $875 for a unit with the router, VMBOX server, and built-in V.90 modem. Other models are also available, including the $775 IA2000 with a serial port for connecting ISDN Terminal Adapters and the $695 *x*DSL and cable modem units.

Note that the *x*DSL and cable models don't include the built-in VMBOX server; you'll have to buy a separate e-mail server unit for $595 if you want that feature. Each of the IA2000 models is housed in a chassis the size of an external modem and includes a 10-Mbps Ethernet connector.

SNAPPY INSTALL

Sticking with the theme of SOHO users, the IA2000 is a snap to install and doesn't require any client software other than an e-mail client and a browser to configure the device. The manual is also very thorough and is written in a language that most novice users will understand, complete with screen shots that detail every step.

To configure the IA2000, all we had to do was edit the Windows Hosts file to recognize the default IP address of the unit. The IA2000 also includes a full DHCP server, so any DHCP client can automatically connect to the server and retrieve an IP address and connection information without your having to edit the Hosts file. The configuration menu, which is accessible from any standard browser that works with Java, is very basic and includes only six different screens that you need to set up.

VIRTUAL E-MAIL

The shared-access connection is important, but it's the combination of the router with VMBOX that makes the IA2000 unique. VMBOX can work as an internal or an external server. The easiest way to set up the system is to sign up for a wild-card-alias e-mail account from your ISP.

These accounts provide you with a domain name, such as *pcmag.com*, but you create the prefix names for e-mail—*srigney@pcmag.com*, for example. Wild-card e-mail accounts are very common for ISPs that host domain names, and they usually cost less than $25 per month.

You can enter up to 250 unique e-mail names in the IA2000. Whenever e-mail is sent to your domain, the IA2000 automatically looks at the prefix name and stores it in the correct user's location. If a message arrives with the correct domain and an incorrect or unknown user prefix, the e-mail is stored in a generic root account that only administrators can access.

NO SOFTWARE NEEDED: *Simple configuration is done from within your Web browser.*

The only drawback to using VMBOX for all of your local and Internet mail is that there is no way to access the IA2000 from the road. It is a basic firewall and allows only dial-out connections. To check your VMBOX from a remote location, you'll need to use the forwarding feature.

On our tests, we were able to forward all messages that came with the prefix "steve" to an outside ISP mail account. Though this is helpful for users when they are out of the office on vacation, it is not the best solution for frequent travelers or for those who check e-mail from home during off hours and on the weekends. Unless users remember to forward messages to the IA2000, they won't be able to access their e-mail. Remote and mobile users are probably better off storing their e-mail messages on an ISP-based server.

THE BACK END

A major selling point as well as another singular feature of the IA2000 is its lack of moving parts. The unit includes only flash memory, which you can back up in the event of a failure. The lack of a hard disk makes the IA2000 less susceptible to failure and easy to upgrade just by downloading new firmware. Most other standalone e-mail servers use a hard disk to store messages. The IA2000 stores them on a Windows 9*x* or NT or a NetWare server. You simply have to configure the unit to store all messages in a shared-network directory.

You can also encrypt the messages while they are stored on the server. This is very important, because the messages are basic text files that any user with access to the shared-network directory could read.

The ATronics Internet Access 2000 is a decent dial-out router, but real added value comes from its VMBOX e-mail-server capabilities. If you are looking for a shared-access Internet router, you have lots of choices. If you also need a cheap intranet e-mail solution, consider the IA2000.

ATronics Internet Access 2000. List price: $875. ATronics International Inc., Fremont, CA; 800-488-7776; *www.atronics.com*.

PHOTOGRAPHY BY THOM O'CONNOR

*Estimated reseller price for models 600/350, 6AU. Actual prices may vary. †Actual weight/thickness may vary due to vendor components, manufacturing process and options. Includes battery (and travel cover on ThinkPad 600 models) and excludes external diskette, cd/dvd drives. ‡If applicable, mhz denotes microprocessor internal clock speed only; other factors may also affect application performance. §One billion bytes for HDD capacity. PCs referred to in this ad include an operating system. IBM product names are trademarks of International Business Machines Corporation. Intel, Inside and Pentium are registered trademarks of Intel Corporation. ©1999 IBM Corp. All rights reserved.

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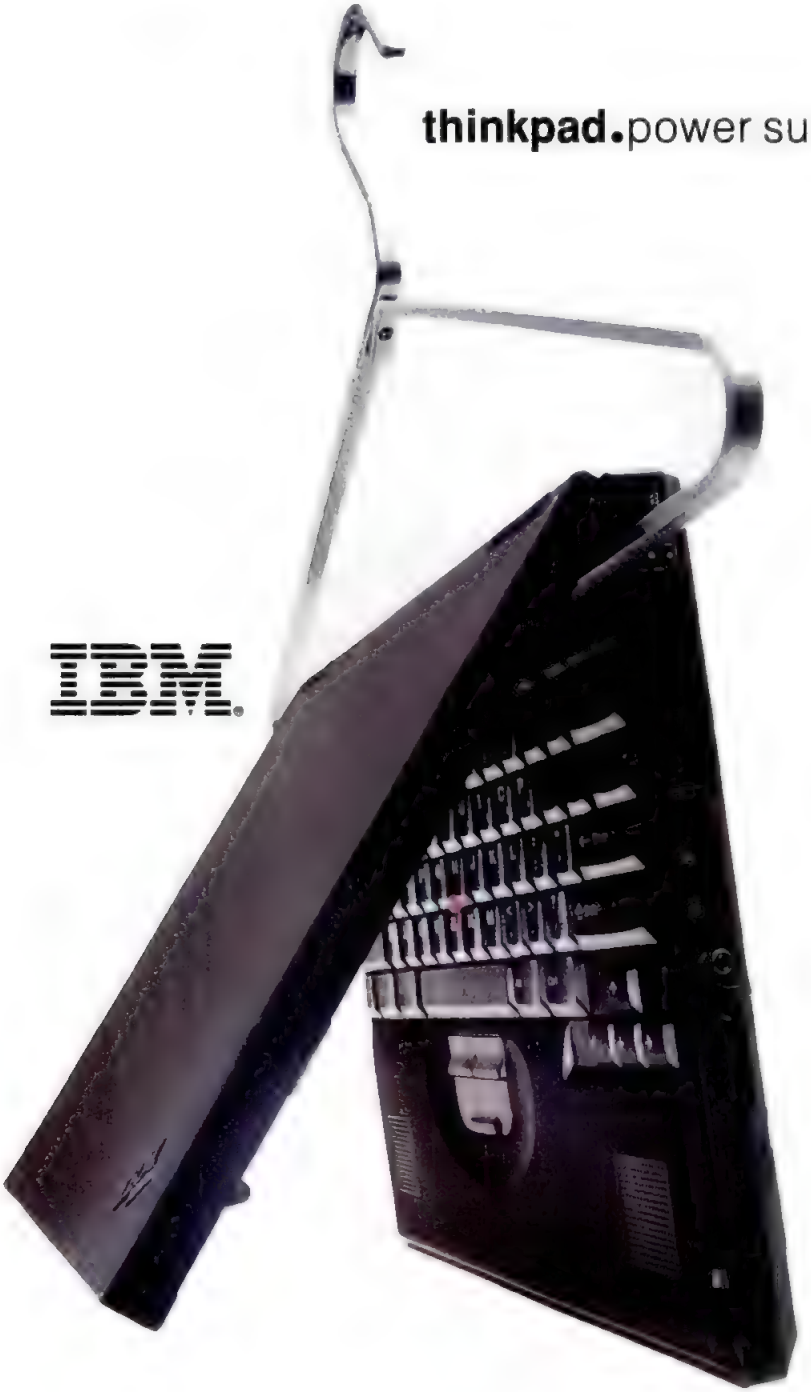

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e-business tools

A Small-Business Print Server

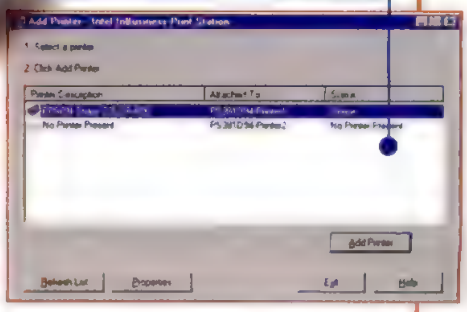
100-Mbps networks can use the inexpensive, flexible Intel InBusiness Print Station to share printers.

By Les Freed

Intel continues its all-out assault on the small business networking market with the InBusiness Print Station ($399 list). The Print Station is a small, flexible Ethernet print server that lets you share two parallel printers on a IPX, NetBEUI, or TCP/IP network. Unlike most inexpensive print servers, the Print Station has an auto-sensing 10/100-Mbps Ethernet connection, so you can use it with 100-Mbps Fast Ethernet networks.

Like the other InBusiness products (Intel's small-business networking line), the Print Station is housed in an attractive gray cabinet. Tabs and slots on the top and bottom of the unit snap into other InBusiness products, so you can stack several units to save space. Two status LEDs indicate LAN connectivity and traffic, and a labeled front-panel button prints a quick test page on both printers.

The Print Station is so small that there's no room on the rear panel for all the connectors, so the power and RJ-45 Ethernet connectors are on the right side of the unit. Curiously, Intel doesn't include a short Ethernet cable to connect the Print Station to a hub or switch.



STEAMLINED: *The Print Station employs its own easy-to-use configuration software.*

Installation is fairly simple, with the basic steps clearly explained on an attractive color fold-out poster. If you don't have a Windows NT machine on your LAN, you must install the Intel Print Station driver software on every PC that will use the Print Station. Fortunately, the software is easy to install and configure, so this step should take only a few minutes per PC.

Windows NT users can install the Print Station software on an NT machine and then share the printer on the LAN using the standard Windows NT printer-sharing tools. This approach lets NT system administrators control and monitor access to the shared printers.

Once you've installed the Print Station software on a client PC, you use the Print Station software—*not* the standard Windows Add Printer wizard—to add and remove printers. The Print Station software includes a detailed configuration panel that lets you monitor the Print Station and set advanced configuration options.

The Print Station we tested installed easily and worked well with several popular ink jet and laser printers. The only shortcoming we noted was the lack of support for Macintosh and Unix systems—both of which are supported in Intel's more expensive NetportExpress print server line. Intel backs the Print Station with a three-year warranty and free (but not toll-free) technical support.

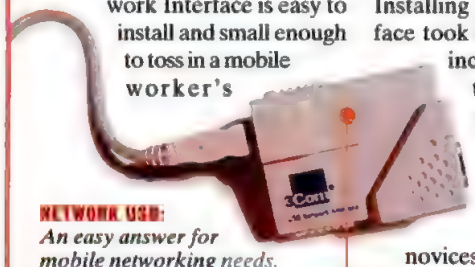
Intel InBusiness Print Station. List price: $399. Intel Corp., Hillsboro, OR; 800-525-3019, 503-264-7354; *www.intel.com*.

Easy Ethernet Hookup

The 3Com USB Network Interface enables a near plug-and-play Ethernet connection.

By Bruce Brown

The new 3Com USB Network Interface ($70 street) is a time- and hassle-saver. The Network Interface lets you connect to networks without opening a desktop PC case and doesn't use ISA, PCI, or PC Card slots. The best advantage may be that there is no performance cost compared with traditional network cards, provided the USB bus isn't used by heavy-bandwidth devices such as speakers. Also, the Network Interface is easy to install and small enough to toss in a mobile worker's traveling PC survival kit.



NETWORK USB: *An easy answer for mobile networking needs.*

The Network Interface measures 1.0 by 2.8 by 2.3 inches (HWD) and weighs 3 ounces with the included detachable 24-inch cable or 1.8 ounces without the cable. A USB port is on one end of the device and an RJ-45 jack is on the other end. Tiny, labeled indicator lights next to the network cable jack indicate link integrity and network activity.

Instructions include a 1-page reference guide and a 17-page guide covering network setup, problem solving, specifications, and technical support.

The device works only with Windows 98 systems, connecting either directly to a PC USB port or to a self-powered hub. Installing the Network Interface took less than 5 minutes, including the time it took to read the instructions. Windows 98's typical awkwardness during peripheral installation could confuse novices. Problems we ran into included a semiblank screen while the device drivers installed and the OS's inability to recognize whether the needed drivers had already been installed. Any Windows 98 problems should be easily overcome by a moderately experienced user.

We tested the Network Interface connected to a 166-MHz Pentium MMX system with 32MB of RAM. In throughput testing, a 294MB file was copied to another system on the LAN in 21 minutes 43 seconds using the USB interface and in 21 minutes 30 seconds via a LinkSys Ethernet adapter.

One limitation of using any USB network connection is that the USB interface doesn't support Promiscuous Mode. This means that you can't run a network sniffer or protocol analyzer, limiting the use of these diagnostic tools.

If you have already embarked on upgrading your network to Fast Ethernet, the Network Interface won't do much for you. The device is limited to 10-Mbps Ethernet connections, as USB's 12-Mbps bandwidth limit precludes use with 100-Mbps Fast Ethernet networks. For many users, however, the convenience and mobility of connecting to a network via USB make the 3Com USB Network Interface an easy choice.

3Com USB Network Interface. Street price: $70. 3Com Corp., Santa Clara, CA. 800-638-3266; *www.3com.com*.

PHOTOGRAPHY BY THOM O'CONNOR

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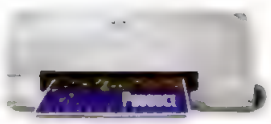

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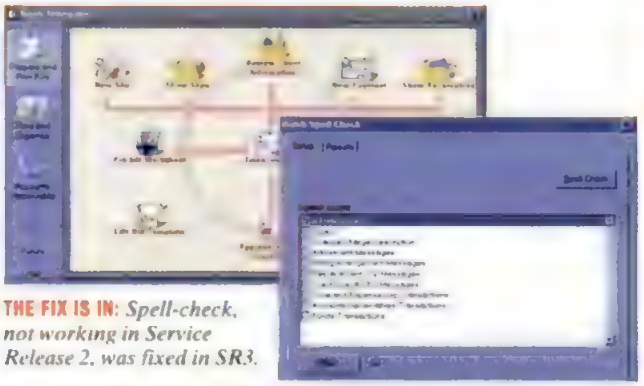
Timeslips 9: A Rocky Start

By Kathy Yakal

Feedback to our First Look review of Timeslips Version 9, from Sage U.S., has been mixed—and rightly so. The rocky start that this ambitious release experienced seems due to several factors: a from-the-bottom-up rewrite of a 14-year-old product, inadequate communication from the company about these major changes, complex installation procedures, data-conversion problems resulting from user databases that had become corrupt over the years, and the unfortunate status quo—minor bugs that require swatting in service releases.

Sage, though, has issued six service releases in not as many months. The company recently mailed a major software update that incorporates SR6 (the sum of all earlier SRs) to all Version 9 users. It contains not only fixes but some design changes for those who were unhappy with the altered command structure of the new version. If further SRs are required, they will be posted online (*www.timeslips.com*).

According to a Sage representative, a sizeable percentage of the reported difficulties affect only users who are moving existing Timeslips databases into Version 9. Corrupt databases that went unnoticed in previous versions balked at the entirely new program structure (you could compare it with using Word to read a corrupted WordPerfect document). If you're experiencing database problems, you can work with technical support to iron them out.



THE FIX IS IN: *Spell-check, not working in Service Release 2, was fixed in SR3.*

Timeslips Version 9 requires two disks for installation: a CD-ROM that holds the program itself and a floppy disk that reads in the correct configuration (version level, single-user or multiuser, and so forth). Though this had been required in earlier versions, the new program structure made installation more complex. Also, users must now enter serial numbers when upgrading, because Version 9 is so different from its predecessors. A Sage representative admits that the company could have done a better job designing the installation features—given this new complexity—but also feels that some problems stemmed from presenting a very different program to users familiar with the old format.

One respondent quite correctly noted that Timeslips Version 9 originally did not link with Amicus (legal case-management software), as Version 8 had. Amicus Version 3.0.3 (which should interface correctly) is still in beta testing but available at *www.amicus.ca*.

New program, new options, and old data—minus the handholding from Sage that could have eased this transition—have resulted in a bad upgrade experience for some old Timeslips customers, though many report being quite pleased with the new release.

Biometric Evolution

By Bruce Brown

We've followed PC-based biometric security technologies since 1997, yet the adoption of biometric security measures isn't a top-priority concern for many U.S. companies, due to more pressing issues such as Y2K. Reader feedback about biometrics reflected concern about the technologies' not correctly recognizing users—a voice recognizer not identifying someone with a cold, for example.

The Digital Persona U.are.U fingerprint recognition suite is one of our favorite biometric devices. Fairly inexpensive, the U.are.U is a snap to install and works flawlessly, recognizing correct fingerprints and not accepting incorrect ones. The additional software that comes with the U.are.U Plus Version ($150 street), including One Touch Screensaver and One Touch Password, adds value beyond the product's base system.

After realizing the initial benefit from the log-on security, the timesaving and convenience of One Touch Password are welcome. With One Touch Password, you need to associate any application or Web site that calls for a user password only once. On subsequent access—when you start the program or log on to a Web site, for example—you have only to press a finger briefly on the U.are.U reader instead of entering a password.

Since the company currently lacks an enterprise solution, most of Digital Persona's customers have been small office or family users, although many organizations have purchased sample units for testing. Digital Persona's U.are.U for the Enterprise, which will support Windows NT, is now expected by the end of the second quarter of 1999.

www.secondlooks.com

Tell us what you think... How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product every week and summarize your comments here. Below are just a few of the comments from our discussion of Timeslips 9.

IT'S A WINNER! *As a certified consultant with Timeslips, I have numerous clients who have converted to Version 9. Without exception, they are thrilled with the product. Inherent to any new program are some glitches (how many fixes have had to be applied to Microsoft operating systems?), but few software companies with whom I've dealt have worked as hard or been as responsive to problems as the folks at Timeslips. With the release of the latest service update, SR6, the program is working as smoothly as the ones we have had in the past.*

—Ken Kennedy

SHODDY AND UNPROFESSIONAL: *Anyone who has been so unfortunate and unwise as to adopt the latest version of Timeslips already knows that this product can never regain its former reputation as the leading time and billing software for small professional offices. I cannot recommend this software to any user. To avoid its shoddiness and the hidden expense of preserving the features of earlier releases, one would be well-advised to consider many of the other time and billing programs.*

—Robert Dawson

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Just when you thought you were going to die of terminal boredom, desktop computing is fun again. What makes it fun? Hacking. Not the craven, cretinous "challenge" of breaking into remote networks and systems, but real hacking, where you exploit the abilities of the hardware to the fullest, do things that the manufacturers don't necessarily recommend, and learn a bunch at the same time.

Overclocking is the current hardware hack of choice. Actually, there's nothing new about it. Back in 1977, I was overclocking Zilog Z80 chips. In 1984–85, everyone I knew who had an IBM PC AT would slide out the 6-MHz crystal and replace it with an 8-MHz clock. We learned early on that the clock rating on chips was usually a safe average, or one designed to keep the heat down. CMOS transistors, of which microprocessors are made, dissipate power only when they're switching states. So slower speeds mean less heat. But if you're willing to stress the chip a little more or remove the heat, you can go faster.

You can overclock most any chip, but the single best reason for the resurgence of interest in overclocking is the Intel Celeron 300a chip. This processor has proved remarkably tolerant of overclocking, and its L2 cache, although small, runs at full processor speed, so system performance gets a double boost from increased clock rates. Also, unlike some other Intel chips, the early Celerons have no protection against front-side bus speedups. So instead of the standard 66-MHz system bus, you can run at 75, 83, or even 100 MHz. The result: Pentium III–like performance at a fraction of the cost.

Once you start looking into the intricacies of overclocking, you'll find a whole world of favored motherboards, cooling devices, pin-jumping and -taping, and ways to finagle the multiplier locks that set the maximum ratio between bus speed and clock speed.

Overclocking has a dark side. Unscrupulous vendors will take lesser chips, sand off the speed ratings, relabel them, overclock them, and sell them in higher-end systems for higher amounts, with higher profit margins. They may or may not have paid attention to the cooling and reliability issues that a careful hardware hacker takes into account, and you definitely are not getting what you paid for. I'm sufficiently conservative to say that you shouldn't overclock the desktop systems at work, but what you do with your home system is your business. A Web search will yield many overclocking resources; a good place to start is *www.hardwarecentral.com*.

You'll also find lots of cooling systems, from heat sinks to fans to Peltier junction devices—semiconductor devices that get hot on one side and cold on the other when electricity is applied. You'll find shareware and freeware that give you access to the temperature monitor built into your motherboard. Some monitor the actual CPU temperature; others just sense the air temperature in the case.

But what would you think if you could run software that reduced CPU temperatures and power consumption and even extended laptop battery life? Such programs exist, and some are free. They're often used in conjunction with overclocking to keep the temperature under control, but they won't benefit every system. The technique is simple: Insert a process at Ring 0 (the Intel architecture's most basic level, reserved for operating-system kernel tasks) that executes the HLT (or "halt") instruction every time the processor is idle. The processor goes into a lower-power mode, and the result is less switching and less power consumed.

These programs, with fanciful names such as Rain and Waterfall, actually do cool the CPU—if you're running Windows 95 or 98. Windows NT already implements the HLT instruction, so there's no net advantage. Do these programs hurt performance? Surprisingly, no. As operating systems have moved from a polled, looping environment to one that is event-driven, and as processor architecture has improved, the processor takes very few clock cycles to move from a quiescent, power-saving state to full speed. Your applications will never see the difference. You see the greatest benefit with applications such as word processors, where the system is waiting relative aeons between keystrokes. You see the least benefit in file transfers and heavy disk activity, which don't give the system time to take a breath.

There are numerous places to learn about CPU cooling; one good resource is *www.benchtest.com*. You can also download Rain and Waterfall from ZDNet's Software Library, at *www.hotfiles.com*. PC

PHOTOGRAPHY BY JAY REED

You shouldn't overclock systems at work, but what you do with your home system is your business.

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Connection Nightmares

Getting a TCP/IP connection globally is not only still a nightmare, but it may actually be getting more difficult. This ugly truth was made apparent when I went to CeBIT and passed through Holland, Denmark, and Germany. Getting a connection was miserable and required calling the United States directly, at over $1 a minute. I've had better luck in the past and sense things are worsening as we approach the 21st century.

When I travel overseas, I have at least three ways to get connected and avoid calling the United States. In Monaco a couple of months before CeBIT, I had an ISDN connection through my laptop's Ethernet card. That experience gave me too much confidence. On this trip nothing worked except spotty direct calls at low speeds.

The trouble began in Amsterdam, where my MSN account (which had previously been able to connect to any UUnet connection worldwide) no longer worked on overseas numbers. I dialed UUnet in Holland and later Denmark, to get nothing but an error message saying to check my password. A direct call to the United States got me connected. Then I noticed in the MSN phone listings that the connection numbers in France—where I was headed next—were no longer available from MSN.

Okay, how about IBM GlobalNet? I was a subscriber some time back and also had a complimentary account. Attempts to dial in got me an error message saying that my account had been revoked and I should contact a service representative. Exactly how I was supposed to do this at midnight in Copenhagen was a mystery to me. What miffed me was that obviously the account had expired, but why didn't it ask for my credit card and reestablish an account?

On to AT&T WorldNet. Never tried it, but it came preloaded on my laptop. First it had to change my file sharing and network connections. Why? I went along with the program and rebooted my machine. Then it couldn't dial out, because it thought I was in the United States. Yeah, *World*Net. Because of whatever changes were made, my laptop couldn't see the flash memory cards with my digital photos on them. This was peachy.

This was getting ridiculous. So I went to the standby for world connections—AOL. While on a slow direct connection to the United States, which cost me a mint, I jumped on to the AOL TCP/IP connection and downloaded some access numbers. I tried to plug them into the computer, and gotcha number four hit me. The Xircom Ethernet/modem combo card I love turned out to be using COM5 for its modem I/O.

The version of AOL on my laptop could only see COM ports 1 to 4. I could have changed this port if I had the Xircom setup disk, but I was carrying an IBM 560 subnotebook without my CD-ROM. Forget it. Airlines nowadays require you to be able to stuff your notebook in a suitcase. I should have updated AOL, but who knew? Connecting through AOL was out.

I decided to make direct long-distance calls. This turned into a joke, too, as I couldn't use AT&T direct or any of the other services that give you a cheaper line. You normally do this by running a handset parallel to the modem and manually entering your credit card number, once you've gone through the rigmarole of getting the outside line and dialing the number. The Xircom incessantly sends a tone over the modem when set for overseas venues. This tone screws up AT&T's ability to decipher the credit card number you punch in, giving you an error message that the credit card number and PIN are invalid. Fabulous.

Back to the direct overseas call. In Denmark, we visited a company called Silcon, which makes huge UPSs for megawatt facilities. The company balked at our hooking to its network, saying this was impossible because of security risks. But we could use the phone system to our hearts' content. This would have been fine, except that nobody could get a direct call to connect, because the Dutch line was so noisy and compressed and attenuated. In a word, it sucked.

I finally managed to get an MSN connection number after an hour of struggle. It connected at a meager 16 KBps, and I got my mail in a slow download. This was ridiculous. The next stop was Germany, where the hotel had no modem connections at all. I had my trusty alligator clips, but the phone was sealed and all wires were hard-wired. So much for global interconnectivity. I was complaining about the same things a decade ago. Nothing has changed.

Exactly how I was supposed to call a service rep at midnight in Copenhagen was a mystery to me.

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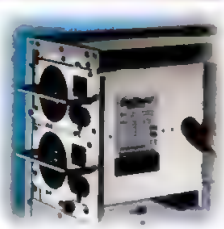

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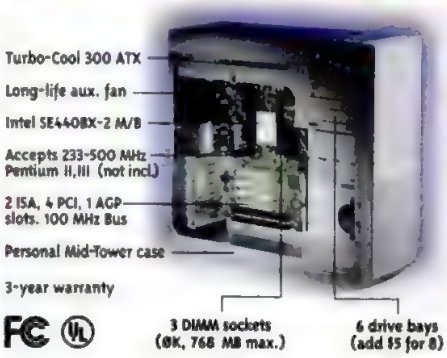

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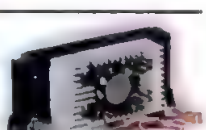

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John C. Dvorak's

INSIDE TRACK

Here We Go Again Dept.: How many times will we see the computer industry **get into bed** with the consumer electronics industry regarding the so-called set-top box? Looks as if **they're at it again.**

Set-top boxes sit on top of your TV and provide **enhanced TV services** and interactivity. Some years back, there was a huge run-up in the stock prices of various companies getting involved in set-top boxes. This was during **the malarkey about 500 channels** that was designed to pump up the value of cable companies. Nothing came of any of it. Then the WebTV nonevent staggered through the scene. But WebTV is actually showing some signs of life.

At the tenth annual Digital Engineering Conference a few weeks back, the next-generation cable box was discussed, and it looks to be yet another variety of the same old set-top box. In fact, there are proposals that make the set-top box **the most important component** of the digital HDTV system and fully integrated within the HDTV architecture in such a way that TV is useless without one. (I hear them howling already.)

Knowing that the only rationale for a set-top box is to **track users and give them targeted advertising,** I'm amused by the various gimmicks to convince people that they want one. Unfortunately, the consumer electronics people can barely keep a straight face over some of this. One iteration had the set-top box provide interactivity with the TV. But nobody wants to interact with a TV, except maybe to change channels or turn it off. The device was **a flop** in all its forms.

Then there was the notion that the viewer could **call his own camera shots.** This system was actually tested in Canada with sports such as tennis. Since this concept required broadcasting multiple video streams and additional work from broadcasters, it was never going to succeed. Then there was the idea that the Internet and TV could interact to give us enhanced viewing pleasure—hah!

The latest iteration (it never ends) is **mini-time shifting.** This is an eye-roller. The new set-top box will have a large hard disk that can capture the show you're watching when you want to go to the bathroom or get a snack or whatever. You can resume where you left off at the touch of a button. This way you don't miss that fabulous slam dunk during a basketball game or that pivotal moment in a movie. This also tells the system that you think what you're watching is so important that you need to save it to disk—**psychographic** information for the **master control** advertising database. It's sick.

The set-top box will eventually be plugged into the home network, and other ways to **capture information** about your habits will be discovered. The joke is that big-time advertisers such as McDonald's and Budweiser are being convinced by free-spending ad agencies that one market subsegment responds a bit better than another to beer commercials depicting **a lizard talking to a frog.** Another minisegment prefers something else. Our privacy is actually under serious attack as part of the continuing **hamburger and beer** advertising wars.

Our privacy is actually under serious attack as part of the continuing hamburger and beer advertising wars.

This whole scene spills over into the **home networking mania** that we're seeing, which is becoming laughable too. It's laughable because of various competing technologies. The cheapest is hard-wired Ethernet, which can be had for $9 to $25 a NIC plus about $100 for a small, fast Ethernet hub. Then there are a variety of **radio LANs.** There's the sluggish Bluetooth initiative, devised for the real purpose of linking cell phones to computers. I see it going nowhere fast.

Then there are the various implementations of the RF LAN based on IEEE 802.11, which should be delivering 2 Mbps shortly. It'll be too expensive. The phone lines of the house will be used for a number of schemes from 1 Mbps to 10 Mbps and should be similar in price if not cheaper than hard-wired fast Ethernet. Then there are a slew of IEEE 1394–based schemes stemming mostly from **consumer electronics companies** such as Sony.

The new Sony PlayStation II, due out for Christmas 2000, somehow plugs into these lash-ups. There has been talk about various IR-based 1394 high-speed networks, but talk is cheap. The scene will be very confusing to consumers. My concern is that unlike a simple hard-wired network, where you don't have to stay with one supplier (D-Link hubs and 3Com NIC cards are intermixed, for example), all these schemes will be **semiproprietary.**

Genuinely Interesting Software at CeBIT: The big computer show in Germany featured a few products that are going to be hot here soon. One of them is **the new antivirus product out of Russia,** called AVP (download it at *www.avp.com*). I found out about **this gem** from friends who comb the Net for such products. I had been using it for a few months before I discovered at CeBIT that it was designed by some fanatics in Russia who are updating it daily! One of its specialties is finding **odd Trojan horses** and other Net-related bugs. The job this tool does is **simply fabulous.**

The other buzz was over yet another Linux vendor, S.u.S.E., which bills itself as the leading Linux supplier in Europe. It's now shipping Version 6.0 and is giving away 6.1 beta disks. The blokes at *PC Magazine,* U.K. edition, **love the product** and bundled a basic copy with a recent issue. When you buy the whole package, you get a 450-page manual and 900 software programs, all for $49.95. It's even CD-bootable. Linux is becoming a rage, and there's no reason not to try out the new kid on the block. Call S.u.S.E. at 510-835-7873 to order a copy, or check out *www.suse.com.* You heard it here first. PC

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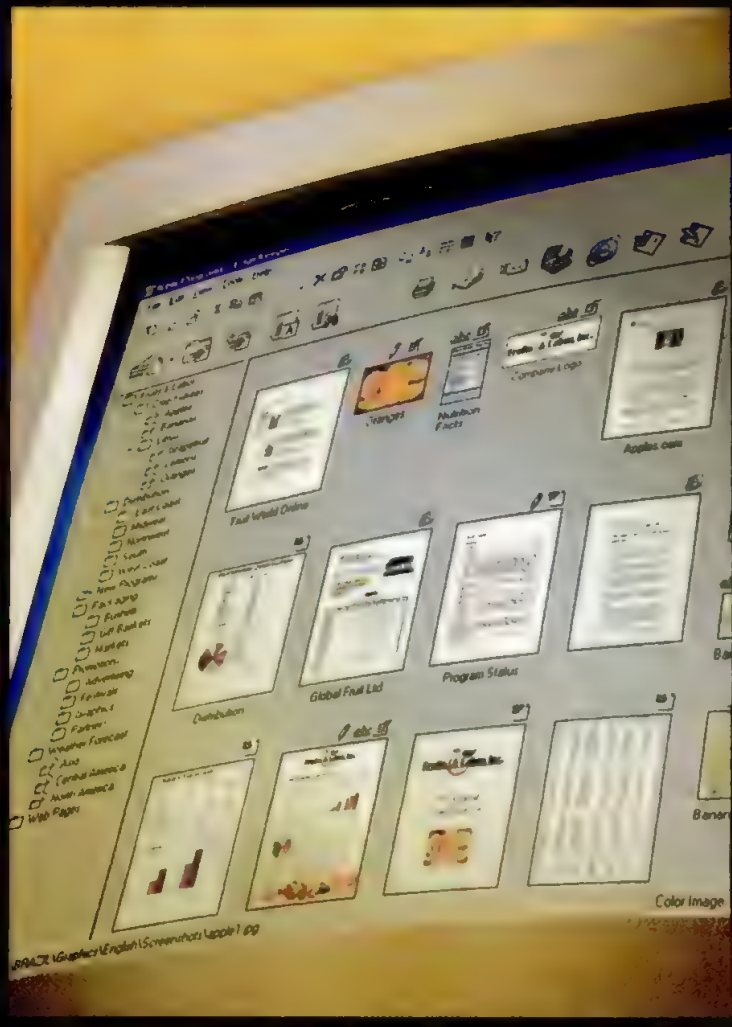

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Jim Seymour

Small and Smaller, But...

Form factor, form factor—who's got the right form factor? That's a big question for notebook buyers today, especially for those of us who suffer from Notebook Schizophrenia. We love the big, beautiful desktop-replacement-class machines, of which the Dell Inspiron 7000 remains the exemplar, but we also go gaga over the Sony VAIO 505s, the Sharp Actius line, the Toshiba 3025CT—the little ones.

To heck with choosing portability over power: We want both. *Now.*

But are even these thin-and-light wonders the ultimate design? Far from it. We see, from time to time, glimmers in other product categories of what a truly thin and light notebook might look like. Unfortunately, we usually find these alternatives don't have enough oomph to serve as a main notebook. But their *form factors*—size, weight, and ergonomics—are pointers to a smaller, thinner, lighter future.

I've been working for a while with a machine that I think should absolutely be the form-factor model for small notebooks. It's *exactly* the right size, weight, and volume for me, as a notebook I can easily carry anywhere, anytime. Yes, what delights my idiosyncratic tastes might not satisfy yours. But I've been loaning this little machine to friends and coworkers for a couple of months now, and the almost universal reaction has been "I want one! They got it *right*!"

I'll go so far as to say that almost all notebook PCs will look much like this one in about three years. This will take advances in screen-display technology, battery technology, power consumption, and CPU heat management—but all those are in the pipeline.

This ideal-form machine is the new NEC MobilePro 800. It measures 1 by 9.5 by 7.5 inches and weighs 2.5 pounds. There is, believe me, magic in those proportions and that weight; taking it with you becomes reflexive, not something you have to think about. In wireless-LAN offices—of which there will soon be many—toting a machine this size and weight will very quickly become a given for many managers and executives. Stick a wireless LAN card in the machine's PC Card slot and you're in business.

NEC has done a great job with many of the super-small machine's challenges. For example, it has a very good keyboard with a 17.5-mm key pitch: not as large as the one I use on my desktop PC, but with about as good a touch, though noticeably shallower key travel.

But the MobilePro 800 is not yet ready for prime time as anyone's sole or primary notebook PC. First, it's a Windows CE machine. That's fine for most work; if all you use a notebook for is occasional word processing, some spreadsheet work, dealing with e-mail, managing your schedule, and jumping on the Web, you could very happily use it today as your primary portable machine.

A Windows CE computer can't run the broad range of Windows apps, though, and cutting yourself off from that treasure trove of software doesn't make sense in a general-purpose machine. Microsoft has done a good job with the mini versions of Word, Excel, Internet Explorer, and Outlook built into current Win CE machines, and a fair job with the Win CE versions of PowerPoint and Access. But all are scaled-down subsets, and you bump into their limitations. PocketWord, the Win CE version of Microsoft Word, for example, is no Windows Write—it's much better than that—but you do get a sense that you're using a program built on the principle of compromise. (Third-party Win CE apps are available, and you can load them onto the MobilePro 800's storage device, but in my experience they generally suffer from the same "minified" limitations.)

One advantage of having these apps built into the ROM is undeniable: Instant-on really works. Tap the power key and you're in business in about 2 seconds. Tap the dedicated function keys that launch each of these apps and you're *working* in a couple of seconds more. Similarly, exiting is an instant process. Of course, having your apps in ROM has a dark side: Generally you can't upgrade to newer versions without replacing the ROM chip.

The 9.4-inch, 800-by-600, 64,000-color screen is big enough at the right resolution, but it's a passive-matrix screen, and we really need the brightness of active-matrix in notebooks. Double-scan just does not cut it for extended use.

NEC uses a touch screen on the MobilePro 800, about which I had some reservations, but I've been

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Jim Seymour

won over. Any machine like this needs a touch pad, and the NEC machine doesn't have one: It still wants you to use a stylus for tapping on the screen to select actions. Tapping with a stylus is perfect for a Palm Pilot–size machine but dumb, dumb, dumb on a machine this size. There's a hidden advantage to NEC's implementation of a touch screen: For many tap-for-cursor-control functions, you can just use your fingertip, which is far faster than pulling out the stylus.

The MobilePro 800 uses CompactFlash cards for storage. In an era of 8GB hard disks in notebooks, the current, relatively puny maximum capacity of CF (80MB) sounds feeble (though Pertec has just offered a 128MB card). But remember that you don't have to devote any of this storage to your basic apps. So how much memory do you *really* need? I've been using a 48MB CF card in my MobilePro 800, and I've not yet filled half that space. Sure, using CF cards for primary storage demands a little discipline—but not much. And the ruggedness, speed, and reliability of CF versus today's notebook-size hard disks are welcome benefits.

I can do a great deal of serious work with the MobilePro 800. Taken together, checking e-mail, managing my schedule, looking up contacts, jumping on the Web, and word processing constitute maybe 85 percent of my time on PCs. And the MobilePro 800 does all those very well.

So is the MobilePro 800 my only notebook PC? No. And I don't think it will be for a while. I carry it on many trips as my only computer, but I'm not yet ready to give up big notebooks. Too many things I do on the road, such as elaborate PowerPoint shows with audio tracks, still demand more power and more storage.

But we're talking about form factors here, and using the MobilePro 800 has taught me a lot about what I really want from a notebook PC and about where we're headed.

The MobilePro 800 is a great choice for a lot of PC users today. At about $1,000, it's a steal. And it's worth a look, even if you are not buying right now or are convinced it isn't powerful enough for you, for the glimpse it provides into the near future. PC

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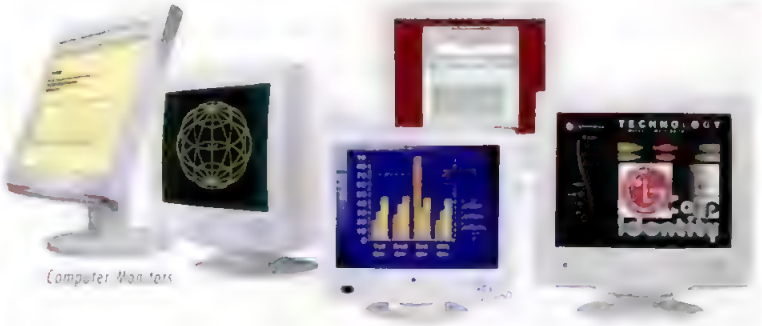

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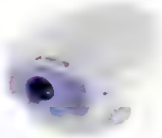

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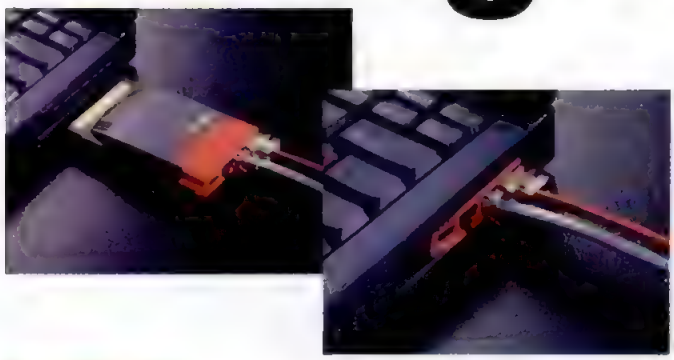

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Bill Howard

Wireless Is More

There's confusing, and then there's c-o-n-f-u-s-i-n-g. Trying to make sense of wireless communications falls into the latter category. Determining which phone standard you want is bad enough: 46-MHz, 900-MHz, or 2.4-GHz analog, digital, or digital spread spectrum for cordless home phones; AMPS, GSM, CDMA, or TDMA for cellular phones. And let's not talk about the rate plans.

Then there's wireless communications for PCs and for PC-workalong products: Recently you may have seen or heard about a wireless communicator built into a prototype 3Com PalmPilot, the return of two-way pagers, and a Franklin Rex Pro electronic organizer that attaches to a cellular phone. Here are some thoughts I've gleaned from seeing or working with a number of these devices.

What you buy today you'll replace tomorrow. The fledgling devices will seem slow and clunky in one or two years. But for many people, the products have enough utility to make them worthwhile investments, even if you mothball them a year from now.

Two-way paging works. When I consider all the device concepts, I'm most impressed by two-way pagers such as the RIM Inter@ctive 950 and Motorola PageWriter 2000X. There's now enough infrastructure to make the devices functional in many major metro areas. They have QWERTY keyboards and multiline displays that let you exchange messages with other two-way pagers and PCs with e-mail, as well as send messages to one-way pagers and to cellular phones with messaging capabilities. You can even have your e-mail forwarded to your pager. You'll pay $250 to $350 for the pager and $20 to $60 (or more) for monthly service. That's about what cell phone service costs, but usage will be different. If your company plans to compete on Internet time, two-way paging is a must-have tool for today.

Digital cellular is a no-brainer. Digital cellular phone service now typically includes Caller ID, voice mail, and paging in the contract or for a few dollars extra. Anyone can send an e-mail page to *yournumber@phonecompany.net*, for example. Voice quality is generally better than with the older analog (AMPS) phones, although you have to choose between the superior coverage and mediocre quality of TDMA and the superior quality and mediocre coverage of GSM or CDMA. Check into deals where one bunch of cellular minutes can be used among multiple cell phones and for long-distance calls from home for a dime a minute. You also can use digital phones with cellular-ready notebook PC modems for passable wireless e-mail connections in the 14.4-Kbps range; really useful 115.2-Kbps and even 384-Kbps connections are a year or two away.

Twofers and hybrids are coming. Expect to see two devices combined into single wireless devices this year. The bricklike Nokia 9000i is both a cellular phone and a two-way Web browser. The announced 3Com Palm VII will add a CDPD packet modem to a beefed-up Palm III housing. Qualcomm's announced pdQ cellular phone will combine the Palm's functionality with a CDMA cellular phone. But there's a gotcha with virtually every device. If it's small, the screen and keyboard (if any) are tiny. Otherwise, the device is too big to fit in a pocket unless your idea of business casual runs to bib overalls.

Watch wireless laptops. If you use a notebook PC and spend your time wandering around the building or corporate campus attending meetings, you owe it to yourself to get a wireless LAN card that slides into the PC Card slot or sticks to the back of the display. The productivity gains are tremendous. Industrial-grade products, such as those from Aironet and RadioLAN, provide 10MB connections. For those who want to connect a notebook PC at home to a fledgling network, there are cheaper short-range versions available too; the best is the Proxim Symphony.

Check out FRS. As far as maximum bang for the buck, the most impressive wireless device I've used recently is an FRS (Family Radio Service) radio. Think of it as CB radio for the nineties, from Cobra, Kenwood, Maxon, Motorola, Radio Shack, and Sony, for about $100 a unit. *PC Magazine* uses FRS in-house for dispatching IS staff; I've used it for keeping track of the family when we're in the mall or traveling in two cars. Cellular and PC data connectivity is zilch, but as a workalong, it's flawless.

Who'd have thought the Dick Tracy two-way wrist TV would truly be just around the corner? PC

When I consider all the device concepts, I'm most impressed by two-way pagers.

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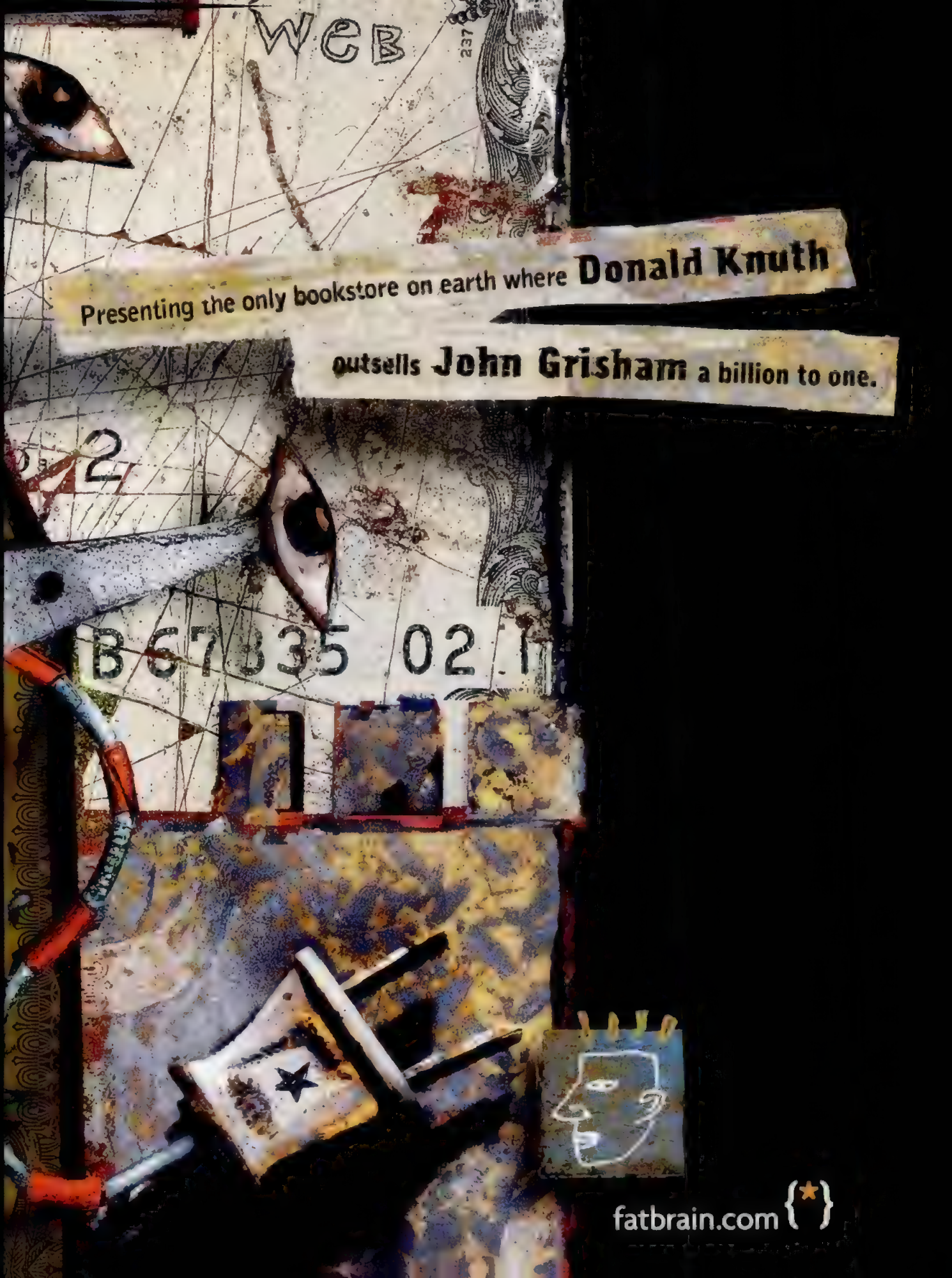
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Should You Upgrade?

By Michael J. Miller

IF YOU'RE ANYTHING LIKE US, YOU CAN'T WAIT TO GET YOUR HANDS ON THE latest and greatest software. But some upgrades require a little more consideration than others. That's especially true if the program in question is not a single application but a suite of tools—many of which are essential to your day-to-day work. The question becomes even more complex if you have many users. The advantages of upgrading must be weighed against the costs both in hard dollars and in deployment and support.

These are the issues now facing millions of users of Microsoft Office 97 and other suites as Microsoft takes the wraps off MS Office 2000. The latest version of this suite, which now claims more than 90 percent of the market, includes new features that work across the entire suite, enhancements to existing applications, and even new applications and packaging. Meanwhile, Corel is putting the finishing touches on its next major upgrade, and Lotus continues to release updates to SmartSuite Millennium Edition. To find out how these versions stack up, PC Magazine Labs tested the shipping version of Microsoft Office 2000, a beta version of Corel WordPerfect Office 2000, and the latest update (Version 9.1) to SmartSuite Millennium Edition.

The most noteworthy feature in MS Office 2000 is its unprecedented integration with the Web. You can now publish almost any document, spreadsheet, presentation, or Outlook calendar to the Web—without giving up the rich formatting of traditional Office file formats. Similarly, you can edit Web pages in Office applications. If your server supports FrontPage extensions, you can use the included Internet Explorer 5 to view MS Office documents and edit Word or Excel files within IE5. In addition, new tools let you create "Web folders" for collaboration, discussions, and subscriptions. Finally, the new Premium Edition includes FrontPage 2000, a WYSIWYG Web authoring and site management tool, and the recently introduced PhotoDraw 2000, a business graphics program.

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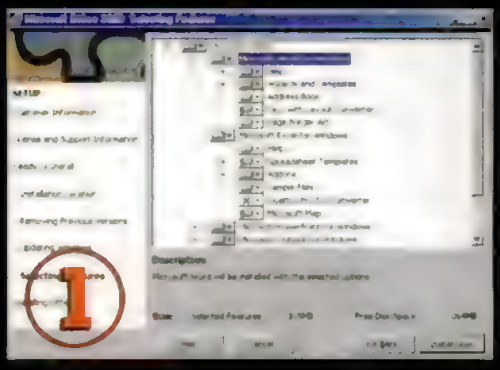
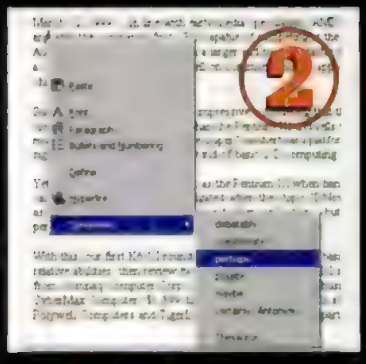
Top 10 New Features of Microsoft Office 2000

As you might expect of a major upgrade to MS Office 2000, there are many new features, plus lots of little enhancements that make your work a little easier. Some add new functionality to the entire suite; others provide individual applications with new capabilities. Here are ten of our favorites.



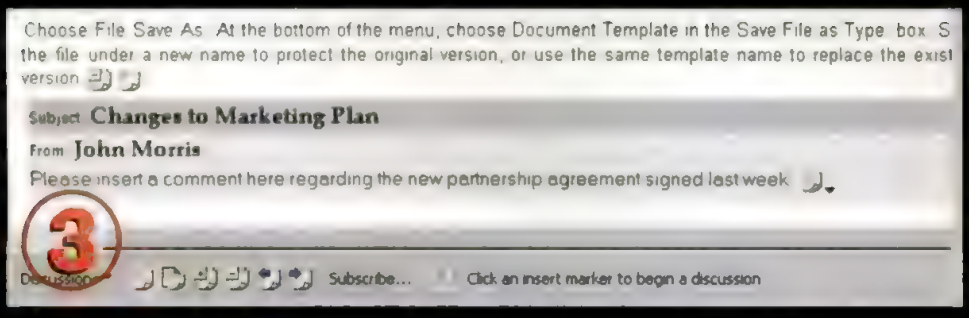
Windows Installer

1 This new setup routine, which is also part of Windows 98 and will ship with Windows 2000, lets you pick exactly the features you'd like to install—all from within a single dialog box. (To customize MS Office 97's setup, you must jump back and forth between multiple dialog boxes.) Furthermore, MS Office 2000 lets you pick features to install only on first use.



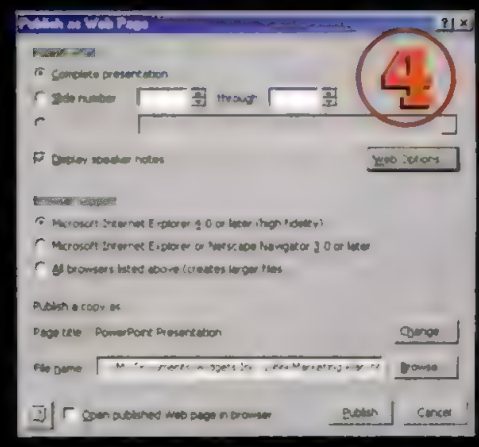
Word's Synonym Finder

2 At a loss for words? MS Office 2000 can help. You can right-click on any word and select Synonym and Word will display a list of alternatives. Select one and it is automatically inserted in your document. In MS Office 97, the Thesaurus feature is hidden in the Tools | Language menu. The new approach makes it faster and easier to polish your prose.



Web Discussions

3 A new collaboration tool, Web Discussions lets you insert comments in documents (both binary and HTML) that are stored on Web servers on the Internet or an intranet. IE5 has a Discuss button and a Discussion toolbar that lets you create and view the discussions. MS Office 2000 also supports the In-line Comments features in MS Office 97 for binary files.



PowerPoint's Save as Web Page

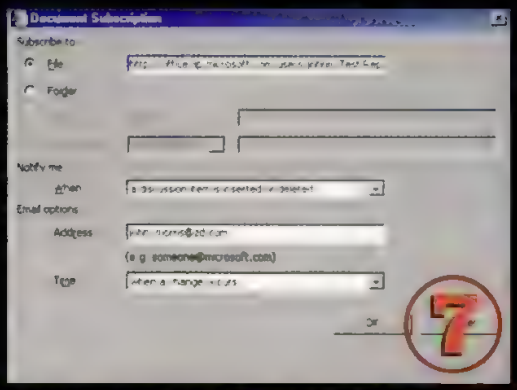
4 Here's a better way to distribute your presentations: on the Internet. The new Save as Web Page feature lets you specify which versions of IE and Netscape Navigator you'd like to target for the best results. And MS PowerPoint is now integrated with NetShow and NetMeeting, so you can broadcast presentations on a schedule and collaborate on presentations.

Edit Documents In Browser

5 A new feature of Internet Explorer 5.0, the Edit button lets you use any application, such as MS Word, to edit both binary and HTML files within the browser. Although this feature will work with MS Office 97, MS Office 2000 takes better advantage of it by inserting a metatag in documents saved as HTML that tells IE5 exactly which application was used to create the document.

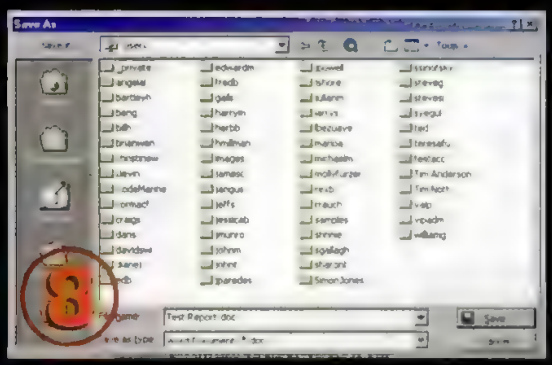
Collect & Paste

6 A completely new feature of MS Office 2000, Collect & Paste lets you copy content from multiple sources within MS Office 2000 applications, including IE5. You can store up to a dozen Clipboard items and then paste them selectively or all at once into a new document.



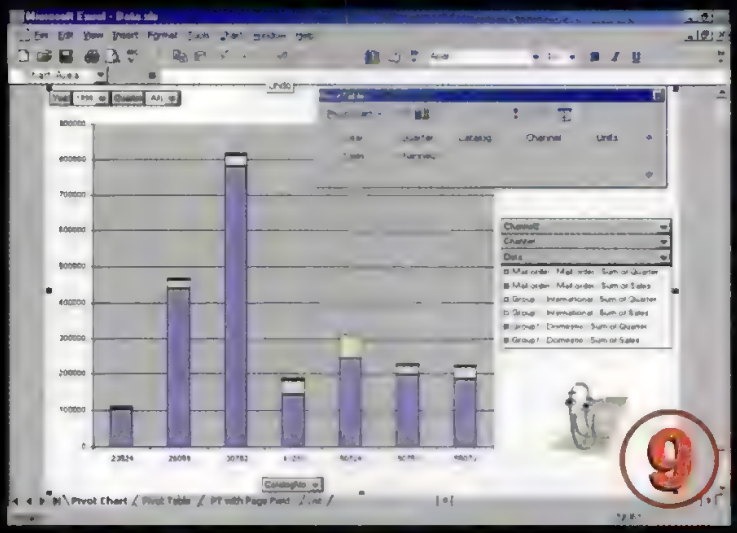
Subscriptions and Notification

7 To keep track of changes made to documents stored in Web Folders, you can subscribe to them. You can then specify what events you'd like to know about, how you want to be notified (via e-mail messages, for example), and when. These features require Office Server Extensions included with MS Office 2000.



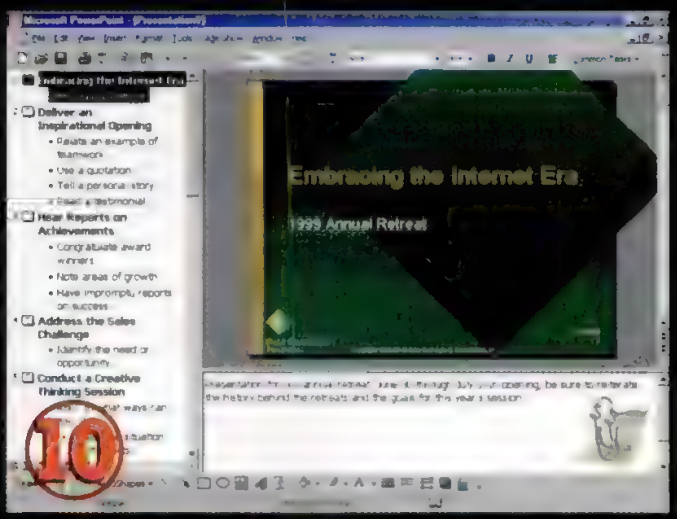
Web Folders

8 With Web Folders, you can work with files stored on Web servers exactly as you would with documents stored locally or on a network. The redesigned File Open and File Save dialog boxes take advantage of FrontPage Server Extensions, so you can access these Web-based folders directly; MS Office 97 lets you save documents but does not let you publish them to Web servers or edit files stored on Web servers.



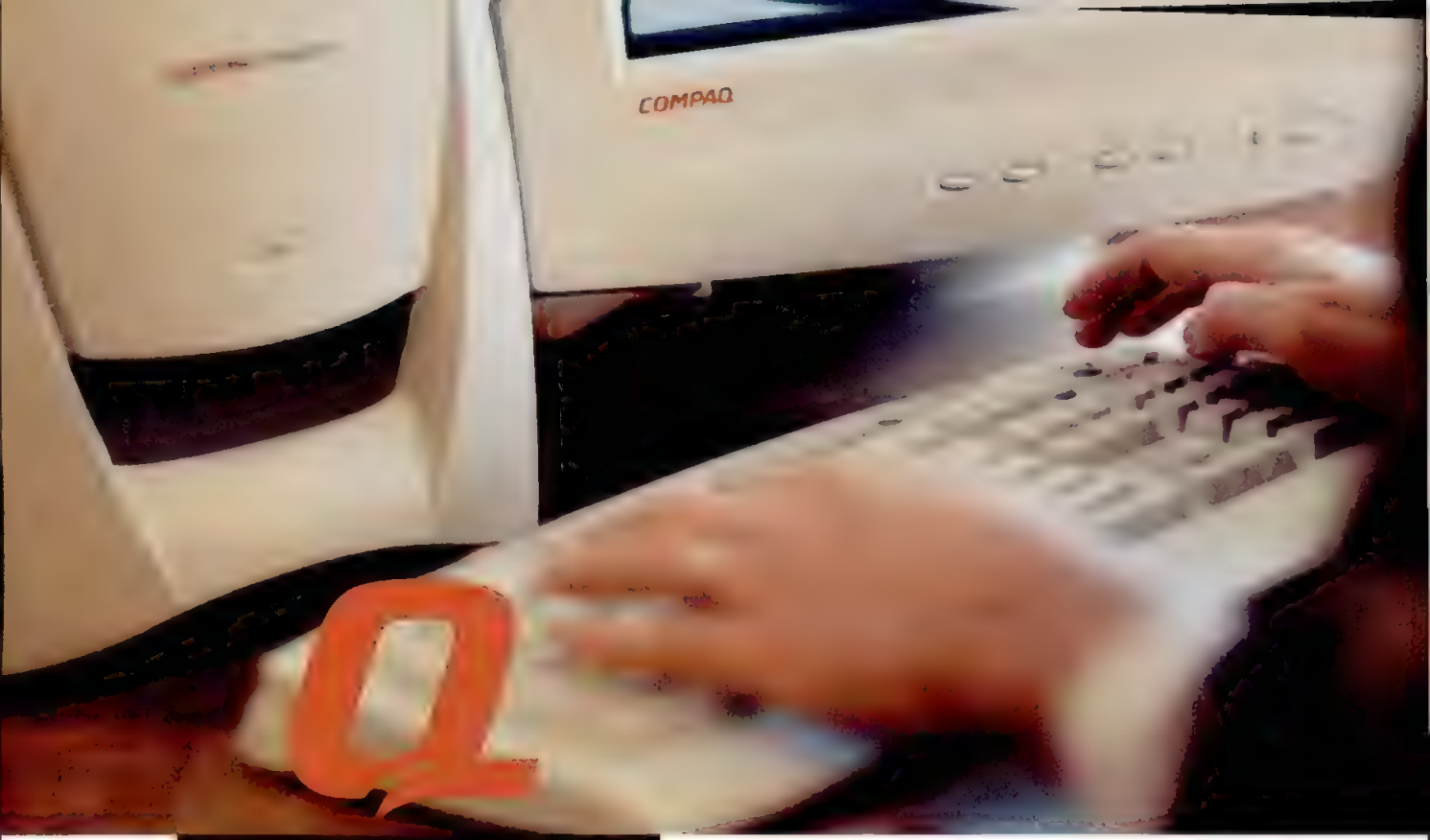
PivotTables and PivotCharts

9 One of the most popular features of MS Excel, PivotTables is now much easier to use, thanks to a redesigned interface. Rather than selecting up front the fields you want, you can simply drag and drop different fields onto the worksheet to build the table you're looking for dynamically. For an even simpler view, you can use the same drag-and-drop concept when viewing data in a chart.



PowerPoint's Tripane View

10 This overhauled interface puts everything you need to know in a single screen. In addition to the outline of the presentation and the active slide, PowerPoint now displays the speaker's notes in a single interface (MS Office 97 relegates the notes to a separate dialog box). This way you can organize your thoughts while viewing the slides.



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• Microsoft Office 2000

PC MAGAZINE EDITORS' CHOICE

There are some 60 million Microsoft Office users out there. Eventually, many will upgrade to MS Office 2000, which is the clear choice among the office suites currently available. The real question is: Should you rush out to get your copy? The answer to this question, like most things in life, is: It depends.

For individual users, we recommend that you upgrade to Microsoft Office 2000 Small Business Edition. Unlike previous iterations of Small Business Edition, this version includes all of the applications in the Standard Edition ($249 list), including PowerPoint, as well as Publisher 2000 and the useful Small Business Tools—all for the same price. This alone makes it worth upgrading.

For businesses, the answer is a little more complex for a couple of reasons. First, Microsoft is really pushing the envelope with many of the new features, especially the Web-related tools, and many organizations may not be quite ready for them. Second, some of the new features depend on back-end technologies, such as server extensions, that won't work on all platforms.

Departments or workgroups that use an intranet or are planning to use an intranet—especially those that have standardized on Microsoft technologies—will get the most out of MS Office 2000. Others will have to weigh the real need for these new features against the resources required to make the move.

The net result of these changes is that you can use MS Office 2000 to integrate your office applications completely with the Web. But to take advantage of all these features, your business must standardize on IE5, set up an intranet (if you don't have one already), and install special extensions on the server—no small task.

The other changes in MS Office are less ambitious but still noteworthy. Among these are a new interface in PowerPoint, more advanced Excel PivotTables (including the option of turning such tables into interactive charts), and improved proofing tools. All the applications share a new clipboard that can hold multiple documents, a new menu system that by default displays only the features you use most often, and a Single Document Interface that displays each open document as a separate button on the taskbar. The last two changes take some getting used to and will undoubtedly be controversial.

By comparison, Corel WordPerfect 2000 and Lotus SmartSuite offer smaller, though still significant, improvements. Corel WordPerfect 2000 offers a useful feature for previewing formatting changes. And the suite includes two new Web publishing tools: Trellix, an innovative tool for designing hyperlinked HTML documents, and NetPerfect for batch publishing. Last fall's update of SmartSuite added a variety of new tools. On the Web integration side, it introduced FastSite, a new tool for quickly turning a variety of documents into Web pages, and an updated version of SmartCenter, a tool for quickly accessing Web and reference information. SmartSuite's tight integration of IBM's ViaVoice with WordPro and 1-2-3 is unique. Corel WordPerfect 2000 still includes a version of Dragon NaturallySpeaking; Microsoft, for the present, has for now left speech recognition out of MS Office 2000.

Both Corel WordPerfect 2000 and SmartSuite now give you the option of using MS Office as default file formats.

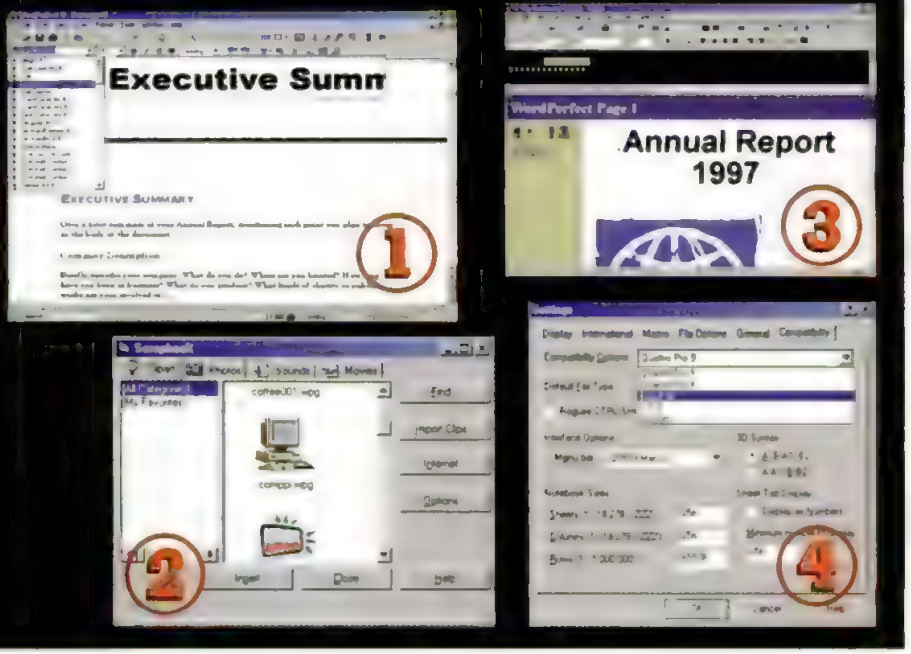
What's New in Corel WordPerfect Office 2000

1 You can see how just about any formatting option (font, paragraph alignment, and so on) will look in your document before making any changes with the Realtime Preview feature.

2 The Enhanced Scrapbook makes it easier to manage clip art, bitmap images, sound, and video. You can create your own categories and even import images from the Web.

3 Corel WordPerfect 2000 now includes a special version of Trellix, a unique Web authoring tool designed for organizing and publishing long documents. Because it works in tandem with WordPerfect, you can export documents to Trellix and it will automatically create logical page breaks and generate navigational aids.

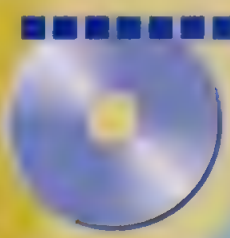
4 There's no way you'll run out of room with Quattro Pro, which now supports up to 1 million rows, 18,278 columns, and 18,278 worksheets. You can set it to maintain complete compatibility with MS Excel or Lotus 1-2-3, and even make XLS the default file format.



MS Office 2000 at a Glance

To get an idea of how much there is to cover in Microsoft Office 2000, consider this: The new Premium Edition includes no fewer than ten primary applications and consumes as much as 526MB of hard disk space. Nevertheless, it is fair to summarize what's new by stating that much of what MS Office 2000 has to offer revolves around the Internet. MS Office 2000 treats HTML files in much the same manner as regular Office file formats: You use the same dialog boxes to open and save HTML files. And by using a special set of XML tags, MS Office 2000 retains the sophisticated formatting and other properties of binary file formats when you convert them to HTML. The individual applications also include many Web-related enhancements. Without question, MS Office 2000 goes farther than any other office suite in making the Web a part of your everyday work.

INSTALLATION



Office 2000 uses an entirely revamped installation routine, Windows Installer, which is actually an addition to Windows 95/98 and Windows NT 4.0. By breaking down the suite into logical components, this technology offers several advantages.

First, you can install only the applications and features that you or your users need. When you request a feature that hasn't been installed already, MS Office 2000 automatically installs it for you—assuming you left the program files on the same CD-ROM drive or network volume.

Each time you launch an Office 2000 application, it performs a self-examination and automatically reinstalls any critical files that have been deleted.

Other key deployment features include file formats that are backward-compatible with Office 97 and, for multinational corporations, a better approach to handling multiple language versions.

SERVER EXTENSIONS

To perform at their full potential, many of the new Web features in MS Office 2000 depend on server-side software. Before deploying MS Office 2000, it is important to consider that this server software runs only on certain platforms. FrontPage Server Extensions let Webmasters administer, author, and browse sites on Web servers created using FrontPage. They also provide the back-end support for components such as hit counters and search features. MS Office 2000 takes advantage of FrontPage Server Extensions to let you open, save, and edit documents stored on Web servers.

Office Server Extensions, which are included with MS Office 2000, support the new Web collaboration features: Discussions as well as Subscriptions and Notifications. FrontPage Server Extensions run on a wide variety of hardware, operating systems, and Web server software; Office Server Extensions require Windows NT Server and the Microsoft IIS Web server.

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What's New in Lotus SmartSuite Millennium Edition

Though still not perfect, these programs are doing a better job of supporting these formats (see "Office 2000 File Compatibility").

In the following pages, we look at five major areas where office suites, led by MS Office 2000, are making changes: Web publishing, collaboration tools, data analysis, setup, and management.

MS Office 2000 clearly represents the biggest step forward, and it includes the most advanced applications. However, it is not inexpensive. New versions sell from about $500 to $1,000, and upgrades from $200 to $600. This makes it a must-buy only if you are ready to take advantage of the new Web features or if you particularly need one of the new features.

Overall, Corel WordPerfect 2000 and SmartSuite tend to offer better pricing. So even though they can't match the Web integration in MS Office 2000 or other advanced features, with their improved file compatibility these suites may be a good alternative for the more price-conscious.

In many ways, MS Office 2000's biggest competition is no longer Corel and Lotus, but rather older versions of MS Office and the new Web-based applications that are already on the horizon.

Web Publishing

Although Microsoft Office 97 gets along with the Internet, it treats Web-based documents as second-class citizens, giving precedence to the paper-based output for which its applications were originally designed. By contrast, Microsoft Office 2000 embraces the Internet so firmly that you may have trouble figuring out where MS Office 2000 ends and the Web begins.

If you have a personal Web site, or if you're responsible for designing your company's or workgroup's site, you'll really benefit from the new publishing features in MS Office 2000. And if you spend more than a couple hours a week on these tasks, you should consider the new Premium Edition (upgrade, $399 list), which includes all the applications in Office Professional Edition, plus FrontPage 2000 and PhotoDraw 2000, a new business graphics program.

While MS Office 2000 applications still use their traditional file formats, they now also treat HTML as a "native" file format. By using special XML tags, MS Office 2000 can convert existing documents to HTML without sacrificing all of the rich formatting found in traditional MS Office files.

When you reopen HTML documents in the MS Office 2000 applications used to create them, all of the properties remain intact—a feature known as *round-tripping*. In fact, if your Web server has FrontPage Server Extensions, you can edit Word or Excel files right in Internet Explorer 5.0.

WEB AUTHORING

If you use MS Office 2000 to create HTML documents from scratch, you'll find that Word 2000 has grown into a respectable Web authoring tool in its own right. This version includes a simple frames editor, better handling of graphics, and design templates that match those in FrontPage, making it easy to create con-

Our Contributors: MICHAEL J. MILLER is the editor-in-chief of *PC Magazine*. GREG ALWANG, EDWARD MENDELSON, and CRAIG STINSON are contributing editors. DIANE JECKER was the project leader, and JOHN MORRIS was the associate editor in charge of this story.

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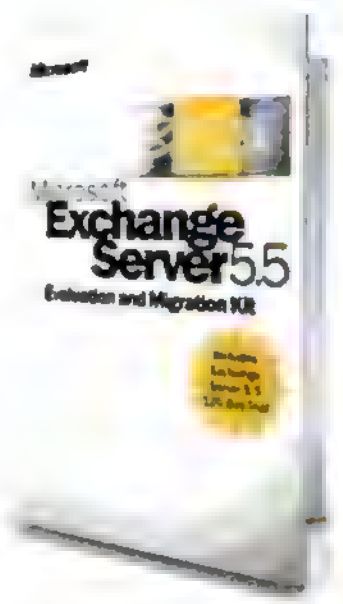

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The Microsoft OFFICE 2000 FAMILY

	STANDARD EDITION		SMALL BUSINESS EDITION		PROFESSIONAL EDITION		PREMIUM EDITION		DEVELOPER EDITION	
	For widespread deployment in corporations standardized on Office. Includes core applications required by users who typically perform word processing and basic spreadsheet tasks.		Designed for the SOHO market. Includes the Office applications plus upgraded Small Business Tools that help users create professional-looking documents and accomplish tasks more quickly.		For managers who will take advantage of more than the basic word processing and spreadsheet tools, including presentations and personal databases.		For power users or those within companies responsible for Web authoring and site management, as well as typical office productivity tasks.		For developers who need a comprehensive suite to build, deploy, and manage solutions based on Office 2000. See "Microsoft Office 2000 Developer" in this issue's Solutions section.	
■ YES □ NO	97	2000	97	2000	97	2000	97*	2000	97	2000
Street prices: upgrade / competitive upgrade / new	$250 / $250 / $500	$210 / $250 / $500	$250 / $250 / $500	$210 / $250 / $500	$350 / $350 / $600	$310 / $350 / $600	—	$400 / $500 / $800	$540 / $540 / $800	$610 / $650 / $1,000
Word	■	■	■	■	■	■	—	■	■	■
Excel	■	■	■	■	■	■	—	■	■	■
PowerPoint	■	■	□	■	■	■	—	■	■	■
Outlook	■	■	■	■	■	■	—	■	■	■
Internet Explorer	■	■	■	■	■	■	—	■	■	■
Publisher	□	□	■	■	□	■	—	■	□	■
Small Business Tools	□	□	□	■	□	■	—	■	□	■
Access	□	□	□	□	■	■	—	■	■	■
FrontPage	□	□	□	□	□	□	—	■	□	■
PhotoDraw	□	□	□	□	□	□	—	■	□	■
Programming tools **	□	□	□	□	□	□	—	□	■	■
Hard disk space (full installation)	187MB	189MB	250MB	360MB	191MB	391MB	—	526MB	210MB	656MB

* The Premium Edition is a new product, introduced with Office 2000. ** Office 97's programming tools include Printed Developer Application Replication Manager, Royalty Free Microsoft Access Runtime, and Visual Basic for Applications 5.0. In addition, Office 2000's programming tools include COM Add-in Designer, Package and Deployment Wizard, Visual SourceSafe, and Visual Studio.

sistent-looking Web sites. PowerPoint has a new Save as Web Page option that lets you target specific versions of browsers for the best results. And you can now export your Outlook calendar to HTML.

FrontPage, Microsoft's popular WYSIWYG HTML authoring tool, has also gotten an overhaul as part of its introduction to the MS Office 2000 family. FrontPage 2000 now displays the page editor (FrontPage Editor) and site manager (FrontPage Explorer) in the same window, and it does a better job of importing HTML documents. The new Database Results Wizard lets you add dynamic database queries to Web pages that connect to any ODBC-compliant database, such as Access, on a Web server or network server.

If your Web server has FrontPage Server Extensions, it can automatically update all links when a new page is uploaded to or removed from the site. And the new Categories Component dynamically lists links for all pages on the site that have the Category property, which can be specified using Word's Properties dialog. This way, your site is always kept up to the minute.

BATCH PUBLISHING

Both Corel and Lotus have also improved their HTML support. But they've also added new applications for batch publishing, especially for company intranets.

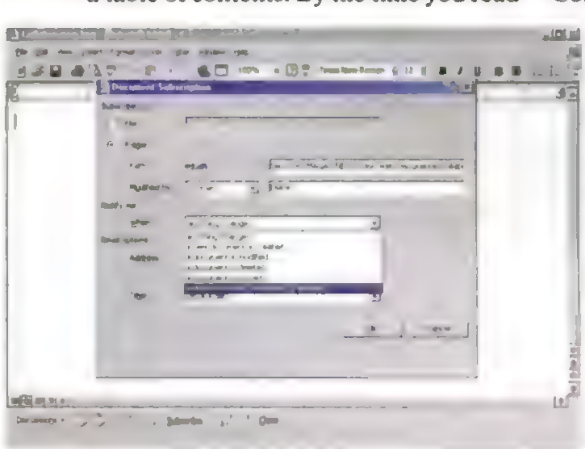
Formerly known as NetDocs, Corel NetPerfect can batch convert files created by any Windows application into Web-ready files and publish them to a server—complete with a navigation frame. Output options include straight HTML, Corel's Java-based Barista format, or HTML controlled by advanced VBA scripting. The whole operation can be scheduled to run without any user intervention.

Similarly, Lotus SmartSuite Millenium Edition's new FastSite tool converts legacy documents (in SmartSuite, MS Office, and Corel WordPerfect, and other file formats) to HTML and automatically creates a navigation frame and a table of contents. By the time you read this, SmartSuite should include the latest version of FastSite (2.0), which includes more design templates and standalone support for MS Office file formats. While FastSite is simple enough for beginners, it lacks the automation features found in NetPerfect.

Another notable addition to Corel WordPerfect 2000 is a special version of Trellix 2.0. This unique Web authoring tool is designed to create logically structured, hyperlinked HTML documents—complete with navigational aids. The bundled version offers better support for Corel WordPerfect files so you'll get better results when importing existing documents.

As with Outlook 2000, the redesigned CorelCentral PIM can publish calendars and task lists in HTML format; Lotus Organizer requires a separate add-on. Another laudable Web feature in SmartSuite is its new Internet Setup, which lets you configure default HTTP and FTP servers so they are accessible from the suite's File Open and Save dialog boxes.

Clearly, all three suites have made significant strides in Web publishing, making them attractive upgrades for users who are looking to establish or maintain a Web presence. Indeed, the day may not be too far off when word processors will replace WYSIWYG HTML editors.—*Edward Mendelson*



If your server has MS Office Extensions, you can subscribe to documents, so that you are notified whenever changes are made.

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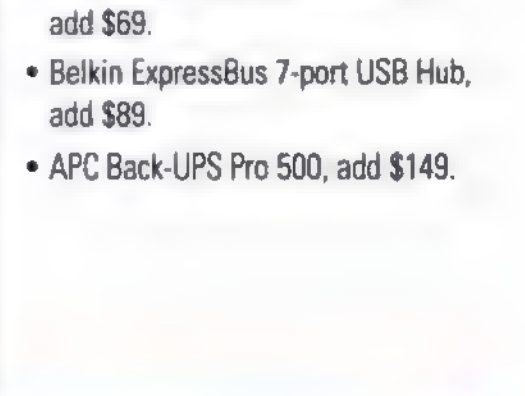

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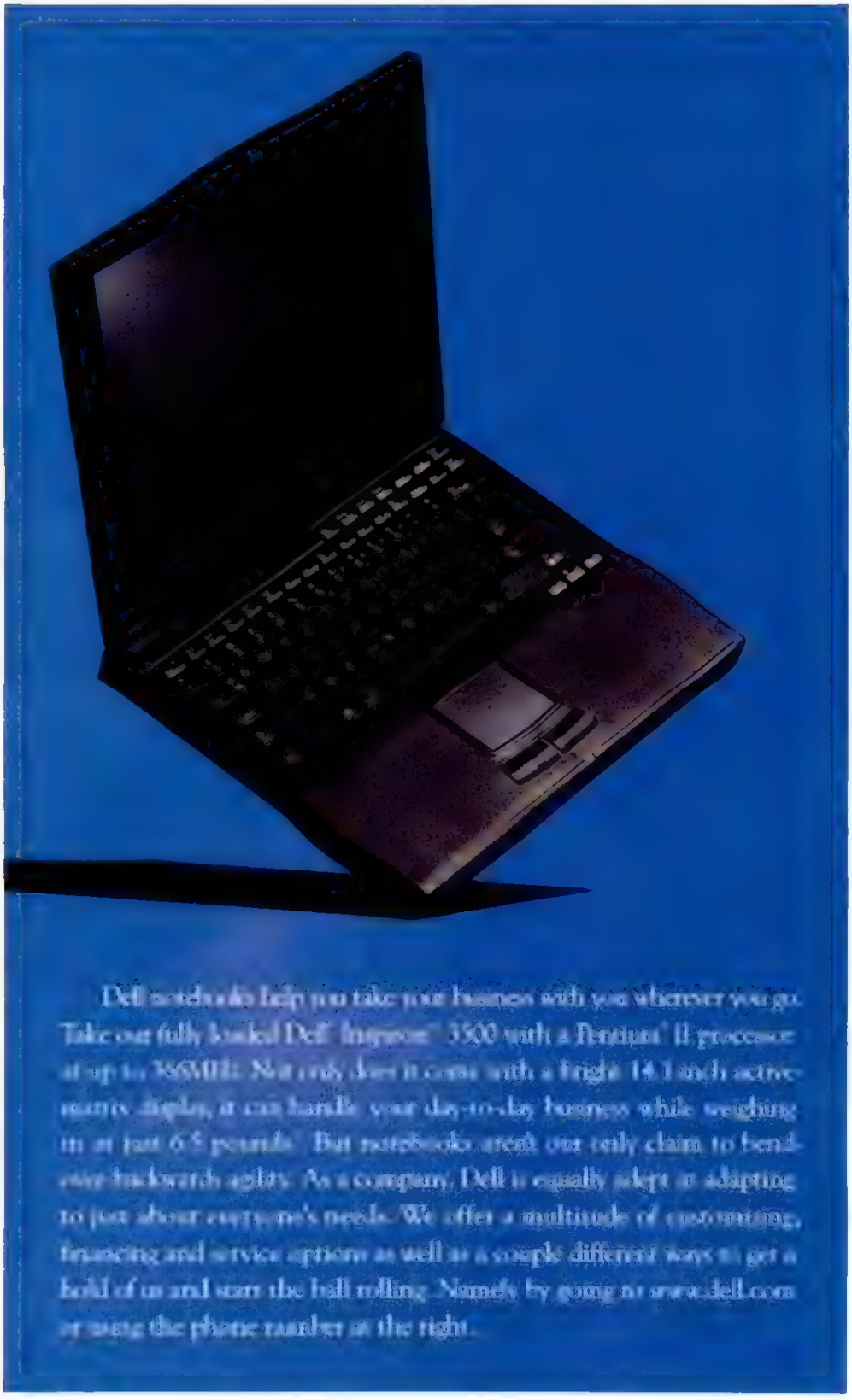

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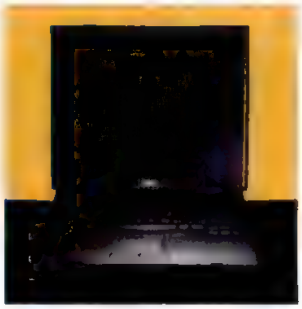

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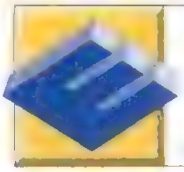

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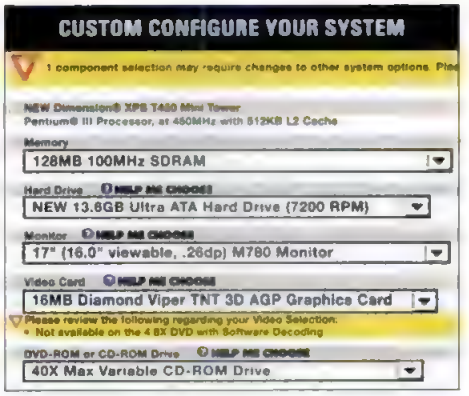

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Collaboration

Most day-to-day work falls into two general categories. There are the documents you create and view, typically with an office suite. And then there are the discussions, which are usually carried out over e-mail or groupware solutions, such as Lotus Notes. The Web creates an opportunity to bring together those two worlds. MS Office 2000 takes the first step in that direction.

The foundation for MS Office 2000's collaboration tools is Web Folders, a new feature of IE5 that makes files and folders on any Web server look like regular files or folders on a local hard disk or network drive. You can access and publish files to Web Folders directly from MS Office's redesigned File Open and Save dialog boxes, and you can even delete, rename, copy or move files between Web folders and a local disk. To use Web Folders, your server must have either FrontPage extensions or the included Office Server Extensions, or support WebDAV, the emerging Distributed Authoring and Versioning protocol.

Once you've set up Web Folders for your workgroup, you can take advantage of two collaboration tools: Web Discussions and Web Subscriptions and Notification. As its name implies, Discussions lets you insert in-line discussions in documents (both HTML and binary) stored on Web servers. This feature will function in all recent versions of both IE and Netscape Navigator, but it works best in IE5, which has a Discuss button and Discuss toolbar for inserting and viewing comments. Both IE4 and IE5 let you view these comments right in the main document window; other browsers open a separate comments pane.

To keep track of these discussions, you can Subscribe to your documents just as you would to a Web page. For example, you can tell the Web server to send you an e-mail once a week notifying you of any changes that have been made to your workgroup's marketing plan. Both Discussions and Subscriptions/Notification require the MS Office Server Extensions.

These collaboration tools are quite innovative, but they have some limitations. Only one user can add a comment to a document at a time, and the document must be closed before the next user can participate in the discussion. More important, these features require server-side software that is not compatible with all platforms. Therefore, companies or workgroups that have standardized on Windows NT Server and IIS, Microsoft's Web server, will have the most luck adopting these new features.—*EM*

Office suites are what's known as a mature category. In other words, just about everything you could pack into a word processor is already in there. But there's plenty new left to do—as these latest suites amply demonstrate. Office suites are addressing whole new areas.

HTML is fast becoming one of the standard file formats for office communications. For our **Web publishing and collaboration** section, we measure the suite's success in embracing HTML and emerging standards such as XML across all applications. The word processor of the future may be the only HTML editor many will need, with sophisticated features such as frames editing, design templates, graphics conversion, and the ability to publish documents directly to Web servers on the Internet or an intranet. By contrast to **authoring tools**, **batch publishing tools** are especially well-suited to converting existing documents to HTML for intranets. **Collaboration tools** let teams work together by providing features such as check-in/check-out, in-line discussions, and versioning. Office 2000 is the only suite here that provides some of these features on Web servers.

The second section, **data analysis**, focuses on the tools for the left side of the brain—spreadsheets and personal databases. The news here is that these applications offer better HTML support and serve as front ends for corporate databases such as a SQL Server.

In the final section, **setup and management**, we evaluate the installation process from the perspectives of both individual users and businesses. The **documentation and support** rating includes the quality, availability, and cost of technical support, as well as the documentation and built-in program help. A wide range of features—troubleshooting, support for multiple languages, and tools for roaming and mobile users—fall under **administration**. Finally, **file compatibility** is a big issue in corporations, where incompatible formats make it difficult to upgrade to a new version.

EDITORS' CHOICE

	Microsoft Office 2000	Corel WordPerfect Office 2000	Lotus SmartSuite 9.1, FastSite 2.0
WEB PUBLISHING AND COLLABORATION			
HTML file support	Excellent	Good	Fair
Authoring tools	Excellent	Good	Good
Batch publishing tools	Fair	Excellent	Good
Collaboration tools	Excellent	Poor	Fair
Site management	Excellent	Fair	Poor
DATA ANALYSIS			
Analysis tools	Excellent	Good	Fair
Web components	Good	N/A	N/A
Integration with enterprise databases	Excellent	Good	Fair
SETUP AND MANAGEMENT			
Standalone installation	Good	Good	Excellent
Network installation	Excellent	Good	Fair
Documentation and support	Excellent*	Good	Good
Administration	Excellent	Fair	Fair
File compatibility	Good	Good	Good

* Including the Office Resource Kit, a free download from www.microsoft.com/office/ork N/A—Not applicable. The product does not have this feature.

Data Analysis

When you think of Web publishing with MS Office 2000, chances are you picture Word. Yet in this version of MS Office, all of the applications have become more Internet savvy, including Excel and Access. Combine that with their expanded database support, and Microsoft is gradually transforming these tools into front ends that make it easier to access and analyze large volumes of data.

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The most significant enhancement to Excel's publishing options is support for interactive spreadsheet components including worksheets, ranges, charts, and even PivotTables (interactive tables that summarize large amounts of data). When you save a chart to HTML, for example, Excel saves all the data with it, so while you're viewing it in the browser, you can change a value and update the chart.

The power of this becomes evident when you publish PivotTables to HTML. For instance, you can create a PivotTable with a year's worth of sales data, post it on the company's intranet, and let all managers create their own views of the data within their browsers.

The Spreadsheet Components have some limitations, though. You can't reformat the chart, some charts such as 3-D columns are not supported, and drawing elements such as arrows and text boxes are left behind in the process. Furthermore, the interactivity works only in Internet Explorer 4.0 or later, and to view interactive charts, you must have an MS Office 2000 license, as well as IE.

When you're going in the opposite direction—extracting data from Web pages—you can use the new Web Query wizard to pull down entire Web pages or selected tables and import them into Excel with no formatting, with HTML formatting, or with rich-text formatting. You could, for instance, automatically pull down specific stock quotes throughout the day. To set the parameters for a query, such as what stock prices to download, you just enter the values in worksheet cells—no knowledge of VBA programming is required. And if you change a parameter, the query is refreshed.

Corel WordPerfect Office 2000 has an equally powerful Web query tool. (In fact, the tools are so similar that they can read each other's query files.) But Corel lets you preview the results of a Web query. This spares you the trouble of deleting Error 404 messages and other debris from your spreadsheet when a query goes awry. Lotus SmartSuite Millennium Edition's 1-2-3 also includes Web queries, but it is more limited: It can fetch only entire Web pages, it must be refreshed manually, and it doesn't save query files so that you can reuse them.

ACCESS INTERNET

Access is not about to be left behind in the rush to the Web. The most important change in Access is a new tool called Data Access Pages, which lets you post data-base components (tables, reports, queries, or data-entry forms) on Web pages. Because these components are "bound" to the underlying database, the pages always provide current data. That means your employees, business partners, and customers can view and work with this data through their Web browsers.

Corel WordPerfect Office 2000 Upgrade, $109 list; new users, $399 (Standard Edition) to upgrade, $209 list; new users, $499 list (Professional Edition). Corel Corp., Ottawa; 800-772-6735, 613-728-8200; www.corel.com.

For example, a company could create a set of Data Access Pages tied to its inventory database. The inventory clerk could then run reports to see which items need to be reordered and update the database as new items arrive—all without knowing how to use Access. Because Data Access Pages can be built using a wizard, no specialized knowledge is required. But they work only in IE5, and all users must have an MS Office 2000 license.

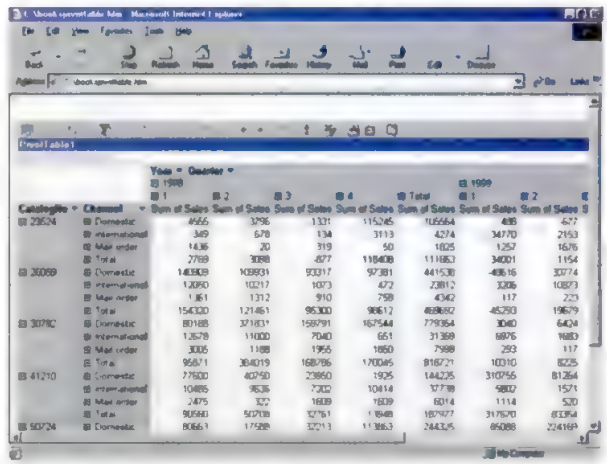
Corel Paradox also offers an HTML publishing capability that lets users view fresh data within a Web browser. Developers can also create interactive, data-bound forms using the new JavaBeans-based Paradox Web Form Designer. Lotus Approach has the ability to publish database components to Web pages, but when the underlying data changes, they must be refreshed manually.

PIVOT POINTS

PivotTables is one of Excel's most powerful data analysis tools. And in this version, Microsoft has made a good thing better.

Instead of specifying an initial field layout within the PivotTable Wizard, you now get a blank table on your worksheet. To build your table, you drag field headings onto clearly marked drop zones. You can also use the intuitive expand and collapse buttons to restrict fields to particular items. For example, if one of your fields is Years, you can use the drop-down box to select data from All Years or from just 1999.

More important, Excel now offers PivotCharts—which are graphs derived from and tied to data in a PivotTable. These interactive charts make it easy to analyze complex data in a graphical format by dragging and dropping fields around the chart to create the views you want. These new features will expose Excel's powerful crosstab engine to a wider audience.



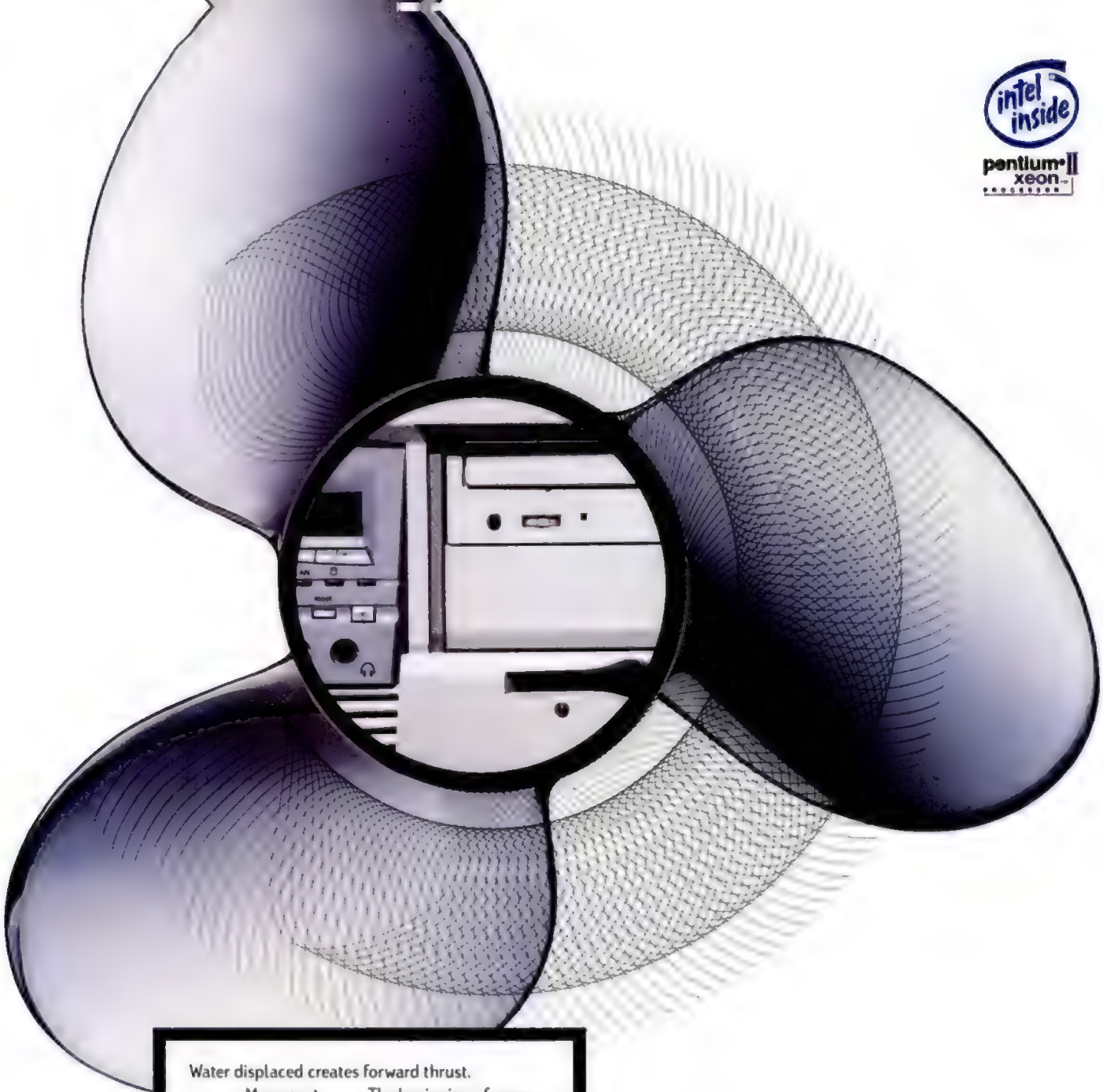
MS Office 2000 lets you publish interactive PivotTables to the Web, as well as graphs called PivotCharts (not shown).

Because Excel 2000 supports OLE DB, a standard database interface, you can use PivotTables and Charts to tap OLAP as well as relational data sources. (OLAP, or OnLine Analytical Process, is a type of database that lets you process queries and create multidimensional views of large data stores more efficiently than relational databases.) Any OLE DB for OLAP provider, such as Microsoft SQL Server, can serve as a back end. Similarly, Access now supports OLE DB, so you can connect directly to Microsoft SQL Server.

CROSSTAB COMPETITION

Corel has also made some notable changes to its analysis tools. The latest version of Quattro Pro boasts enhanced crosstab features, OLAP support, a massive worksheet capacity, and other enhancements.

Quattro Pro's new crosstab command is a welcome replacement for the Data Modeling Desktop applet found in older



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versions. Like Excel 97's PivotTable wizard, the crosstab command requires you to lay out your table within a dialog box. And Quattro Pro's crosstabs support many of the same features as those in Excel 97. In addition, you can now run crosstab queries on OLAP databases using one of two interfaces: CorelOLAP or MSOLAP. But, because Quattro Pro still lacks a relational query tool such as Microsoft Query, crosstab commands can't be easily applied to selected records.

One area in which you won't be limited is in the size of spreadsheets. Quattro Pro can accommodate up to 1 million rows, 18,278 columns, and 18,278 worksheets—though we don't recommend you try this at home. A more practical feature is its ability to configure worksheets for complete compatibility with Excel or 1-2-3; you can even make XLS your default format.

SmartSuite Millennium Edition offers little in the way of new analysis tools. To generate a crosstab view of data, 1-2-3 requires the Lotus Approach database (it uses OLE to embed Approach within a 1-2-3 worksheet). These crosstab tables are far less dynamic than their counterparts in Excel and Quattro Pro. For example, they can't be reformatted or charted easily. Lotus offers no native OLAP connectivity.

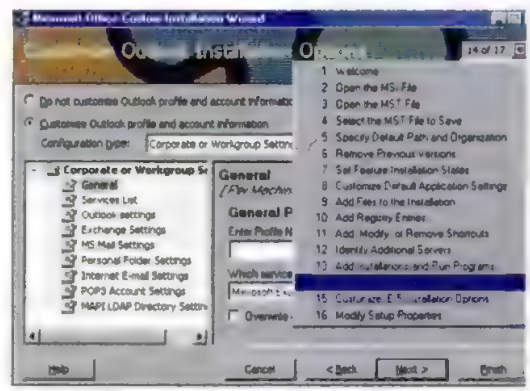
The Spreadsheet Components, Data Access Pages, and new analytical tools in Excel and Access make it worth the upgrade price if you spend a lot of time working in these particular applications. They also point the way toward a new role for MS Office 2000 as a platform for Web-enabled business decision making.—*Craig Stinson*

Setup

Setup is hardly the sexiest issue to consider when determining whether to upgrade, but it can be one of the most critical. That point was driven home when Microsoft released Office 97. Customers soon discovered the file formats weren't backwards compatible, making it difficult to move to the new version, especially for larger businesses. This time around, Microsoft has learned from its mistakes and devoted much attention to making the setup smoother sailing.

All of the applications in Microsoft Office 2000 are backward-compatible with MS Office 97, with the notable exception of Access. On our tests, we encountered no problems passing all other file types between MS Office 2000 and MS Office 97.

With your mind at ease about file formats, you're free to move on to the actual installation. The first thing you'll notice is the Windows Installer, which gives individuals and workgroups far more control over installation than did MS Office 97. From a single dialog box, you can not only pick which features to install or not install, but also select features that should be installed only when you first use them or that should run from the program CD. For example, we told MS Office 2000 to run the Clip Gallery from the CD to save space on a laptop but to set all the Word templates so that they would be installed as we needed them. Corel WordPerfect Office 2000 offers a similar feature called Install-As-You-Go.



MS Office 2000's Custom Installation Wizard helps you create custom network installations.

Lotus SmartSuite Millennium Edition
Upgrade, $149 street; new users, $399 street. (Lotus FastSite 2.0, $99 list.)
Lotus Development Corp., Cambridge, MA; 800-343-5414, 617-577-8500; www.lotus.com.

All three office suites automatically remove previous versions during installation. But MS Office 2000 gives you more options. The new Removal Wizard lets you pick the MS Office 97 applications that you want to remove or hang onto. And when you upgrade to MS Office 2000, the setup program can automatically pick up all of your MS Office 97 settings and preferences and apply them to the new version. For example, if you've told Word 97 not to AutoFormat numbered and bulleted lists, MS Office 2000 will also know better.

NETWORK INSTALLATION

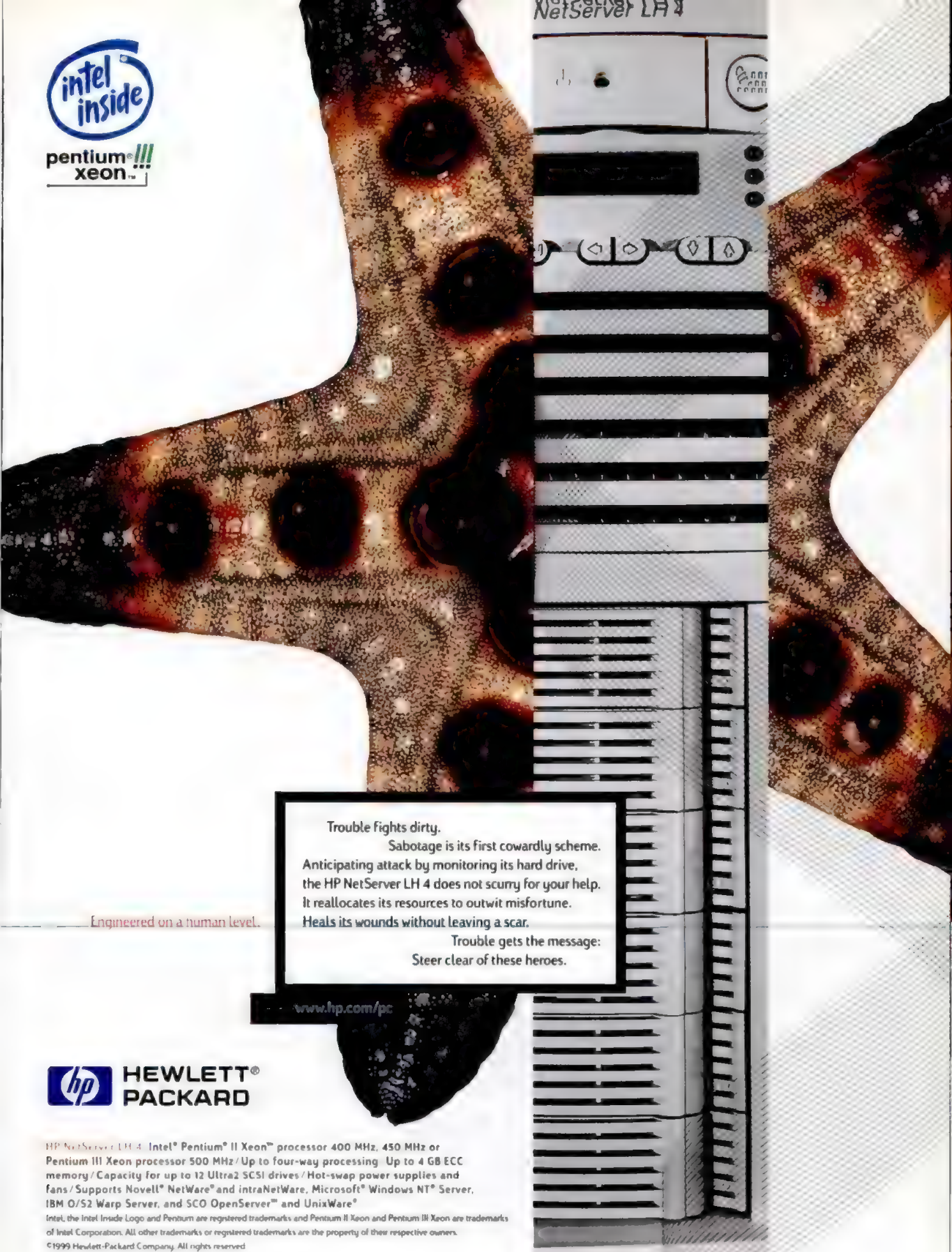
If you are setting up multiple systems, you may want to put MS Office 2000 on a centrally located server rather than running around with a program CD. By creating consistent, basic installations of MS Office 2000 for all users, you can cut down on training costs up front and help to minimize the number of support calls. One must-have if you plan to do this is the MS Office 2000 Resource Kit (download from *www.microsoft.com,* free; CD and Manual, $60 street), which includes several tools for customizing MS Office 2000 for unattended installations.

The first tool, the Custom Installation Wizard, is used to create two independent files: a *Windows Installer* file, which describes the components and configuration of your base installation, and a *transform* file, which modifies this base installation to suit the needs of particular groups of users. The benefit of this two-pronged strategy is that you can create different configurations based on the same installation package. You might, for example, start with a standard configuration and let various departments customize that configuration by selecting certain components (or even changing the default language).

The MS Office 2000 Resource Kit also includes a second wizard, the Office Profile Wizard, that makes it extremely easy to modify your base installation. To use it, you simply create a prototypical MS Office 2000 client with the features, menus, and toolbar items you want and then take a snapshot of it. The wizard applies these settings to the transform file, so users get exactly the MS Office 2000 they need.

Corel comes closest to offering setup features that match those in MS Office 2000. The new Corel Distribute utility creates setup profiles and automates the process of installing them from a server. Like Custom Installation Wizard, Distribute has a wizard that lets you select the features you want to include. However, the utility is less robust than Microsoft's, because it generates a single installation file that can't be modified; to change the settings, you must go through the wizard again and create a whole new installation.

The Corel Settings Editor, in turn, lets you manually control Corel WordPerfect 2000 settings via the Windows Registry. Like Microsoft's System Policy Editor



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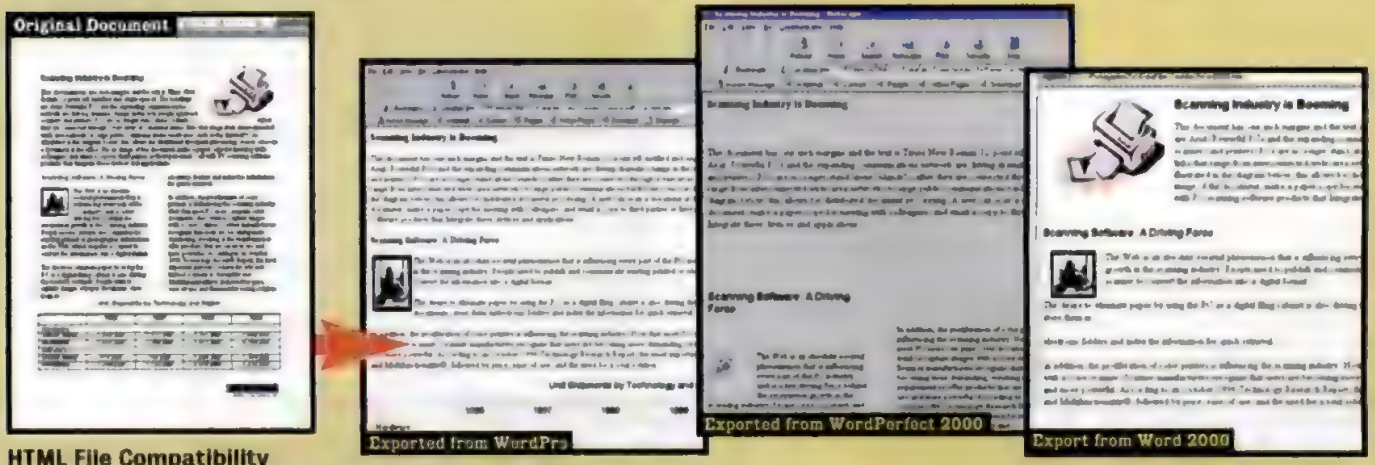
Office 2000 File Compatibility

Two factors have pushed the issue of file compatibility to the forefront. The first is the increased use of Web file formats in everyday documents. Office suites should export documents to HTML as well as return them to native formats. Second, Microsoft Office has become so prevalent that Corel WordPerfect Office 2000 and Lotus SmartSuite Millennium Edition must support MS Office 97 file formats. We tested both these compatibility issues.



HTML File Compatibility

All three word processors had little trouble converting simple text documents to HTML, but we did discover differences on more complex files such as this one-page newsletter. Word 2000 gave us a thoughtful warning that explained which features would be lost. In this case, it dropped the two-column layout, changed the positions of graphics, and made the document slightly longer. When we brought it back into Word 2000, however, the layout was restored, but graphics were still in the wrong position, and the document was running to two pages.

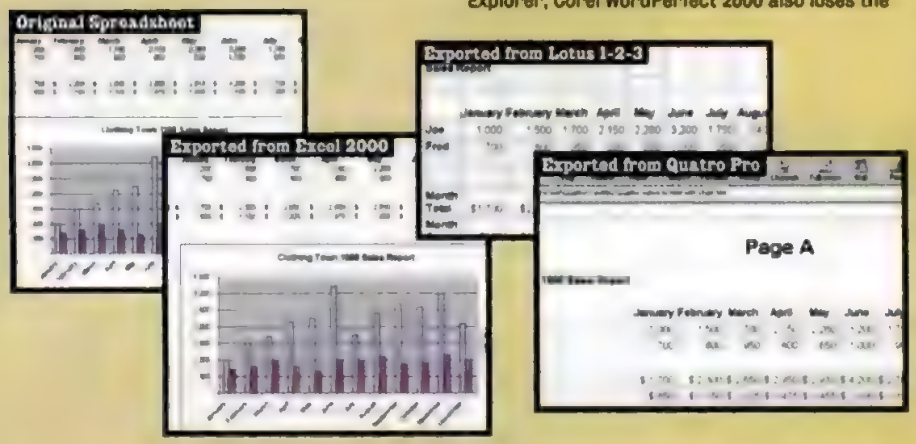
Corel WordPerfect 2000 inexplicably turns the background gray, and although it preserves the two-column layout in Netscape Navigator 4.5, it drops all of the graphics. In Microsoft Internet Explorer, Corel WordPerfect 2000 also loses the two-column layout. When you open it back up in Corel WordPerfect 2000, the document no longer contains the columns or graphics.

Lotus Word Pro's HTML Export Assistant gave us lots of options, including the ability to specify JPEG or PNG (but not GIF) graphics. When viewed in the browser, the documents looked quite good—especially the graphics. Like Word 2000, it lost our two-column layout and seemed to have trouble with simple indents. But it was the only product that successfully round-tripped our animated GIF file.

Excel 2000 worked nicely with IE5, but not as well with Navigator 4.5 (it moved the chart to the top of the page).

When you save to HTML in Corel Quattro Pro, you lose any charts in the file. Data comes through fine, but there is no way to round-trip files—for example, import HTML into Quattro Pro. When we attempted to do so, the file became unreadable, and Quattro Pro generated a VBA error.

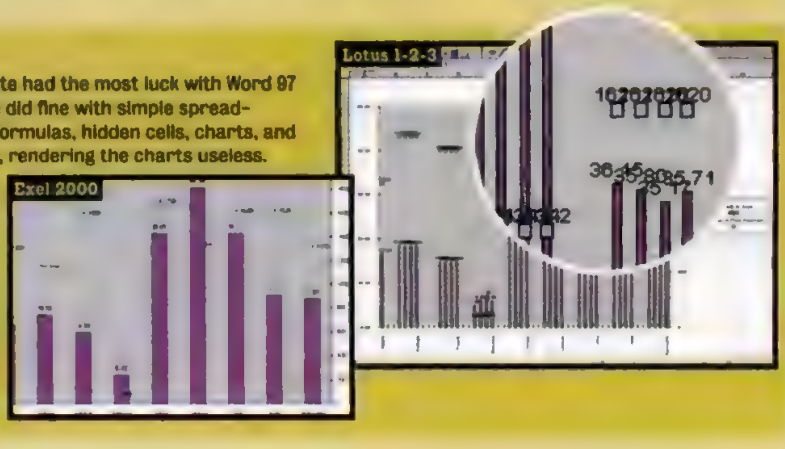
Lotus 1-2-3's Save as HTML doesn't support charts. However, you can use Net-It Now's Jdoc technology to export charts to HTML. Our HTML-based spreadsheets round-tripped to 1-2-3 fine.



MS Office 97 File Formats

On the whole, we found Corel WordPerfect 2000 and SmartSuite had the most luck with Word 97 documents. Likewise, Corel WordPerfect 2000 and SmartSuite did fine with simple spreadsheets. However, they struggled on more complex ones with formulas, hidden cells, charts, and PivotTables. Both products attempted to chart hidden values, rendering the charts useless. The beta version of Quatro Pro also inserted errors in every cell that contained a formula that referenced a hidden cell.

In contrast to word-processing and spreadsheet documents, support for Microsoft PowerPoint presentations in Corel WordPerfect 2000 and SmartSuite is still quite limited. Lotus Freelance Graphics only supports PowerPoint Versions 3.0 through 8.0, so you have to save PowerPoint 97 files back to one of these versions before importing. The beta version of Corel WordPerfect 2000 does not support PowerPoint importing; the final version should have this feature.



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Office Alternatives

There are other options for office suites out there—and we're not just talking about Corel WordPerfect Office 2000 and Lotus SmartSuite Millennium Edition. Despite the long odds, a handful of other suites stand their ground.

Formerly ClarisWorks, **AppleWorks** ($99 list) has been under the aegis of Apple for one year. Despite the name change, the current product is identical to ClarisWorks 5. Nevertheless, AppleWorks retains a loyal following in education and among new users.

What distinguishes AppleWorks is its exceptional integration. AppleWorks functions more like a single program. When you launch it, a dialog box asks what type of document you'd like to create and AppleWorks selects the right tool. And you can embed elements from any module into documents in others.

AppleWorks doesn't try to match the power of MS Office, but it is a good solution for beginners who want a little of everything in an integrated package. (Apple Computer Inc., Cupertino, CA; 800-538-9696; *www.apple.com.*)

Also targeted at consumers who don't need a full-featured suite, Microsoft Works is actually a family of products.

The core of the product line is **MS Works 4.5** ($54.95 list), an integrated application that includes word processing, spreadsheet, database, and drawing software, as well as Internet Explorer and Outlook Express. **MS Works Deluxe** ($84.95 list) adds Money 99 Basic, a personal finance manager, and Greetings 99. Finally, the flagship **MS Works Suite 99** ($109 list) throws in Word 97, Encarta, and Expedia Streets 98. (Microsoft Corp., Redmond, WA; 800-285-7772, 425-882-8080; *www.microsoft.com.*)

A lesser-known suite, Star Divisions' StarOffice attempts to combine all the power of MS Office 2000 into a program with a single interface—a tall order.

StarOffice is available in two versions: **StarOffice 5.0 Personal Edition** is a free 62MB download, and **StarOffice 5.0 Deluxe Edition** is available online for $39.95. Both include the same core applications, but the Deluxe Edition offers more templates, fonts, and clip art, printed documentation, and 30 days of installation support.

The individual applications are quite robust, but the setup program is flawed, and the StarDesktop tends to takeover your PC. StarOffice earns high marks for innovation, but it still has too many rough edges. (Star Division Corp., Fremont, CA; 510-505-1470; *www.stardivision.com.*)—*John Morris*

(part of the Resource Kit), this solution requires a lot more technical know-how—it requires familiarity with editing Registry key—and most users will prefer Microsoft's vastly simpler Office Profile Wizard.

In comparison with Microsoft and Corel, Lotus seems to have done little work on its setup. Lotus SmartSuite Millennium Edition still lacks a wizard for creating custom installation files, so you must edit installation scripts by hand and you still won't get the level of control over individual features, menus, and toolbar items afforded by MS Office 2000. SmartSuite does have one noteworthy new feature, however. QuickInstall is a one-button installation. Just select full, default, or minimum install, and SmartSuite takes care of the rest. No need to wade through wizards that prompt you for information. —*Greg Alwang*

Management

As any administrator can tell you, the job is hardly done once the suite is installed. MS Office 2000 includes several new tools that help ensure the suite stays up and running.

We were especially impressed with the self-repairing feature. Each time you launch an MS Office 2000 application, it checks to see if any critical files are missing and automatically reinstalls them. On our tests, we actually deleted Word.exe, and when we tried to open a Word document, it automatically reinstalled the executable without missing a beat.

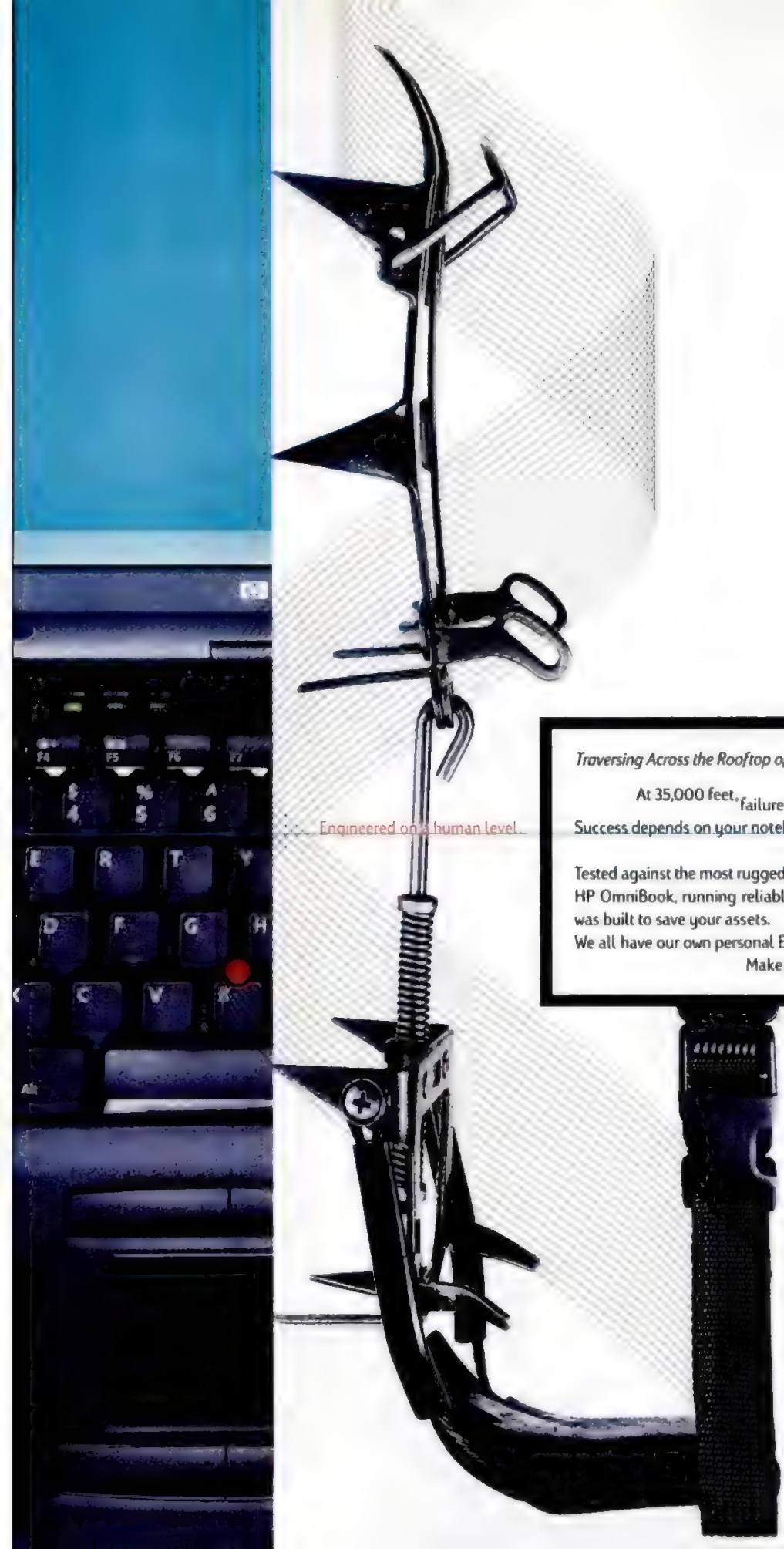
Of course, usually it is less critical files, such as templates or fonts, that tend to go missing. To correct these problems, MS Office 2000 includes an end-user feature called Detect and Repair that performs an audit of your installation and reinstalls any missing pieces.

If you use more than one PC, you'll appreciate a new feature for synchronizing MS Office 2000 installations—something we've long been asking for. When you get a new laptop, you can pack up all your MS Office 2000 preferences on your desktop and transfer them to the new system.

Neither SmartSuite nor Corel WordPerfect 2000 provides repair tools like these. Lotus, however, does have a new SmartUpdate tool (in beta at present time). SmartUpdate checks Lotus's Web site for updates and automatically applies them to network-based installation

Finally, Microsoft has improved the foreign-language support in MS Office 2000. Specifically, the suite is now divided into a single, core executable that works with all languages and 25 separate Language Packs that you "snap in" as needed. MS Office 2000 also provides seamless support for multiple languages within a document. During testing, Word automatically detected which language we were currently using and then switched to the appropriate spell checker and grammar proofing tools. Lotus WordPro can also switch languages on the fly; Corel WordPerfect 2000 supports only one language at a time.

Without question, Microsoft has done more than ever to address setup and management issues. That alone probably won't be sufficient to convince you to make the upgrade, but it ensures that if you do decide to upgrade, you'll have a lot of control over the process.—*GA*



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3-D

PENTIUM III XEON PROCESSOR
The Pentium III Xeon processor comes with 512k of full-speed cache and a set of 70 new floating-point and integer instructions called Streaming SIMD Extensions (SSE). SSE can offer significant performance improvements for graphics-intensive workstation applications that support it.

INTEL-BASED 3-D WORKSTATIONS
These Intel-based 3-D workstations run high-end, 3-D graphics–intensive applications such as MCAD (mechanical computer-aided design), animation, 3-D modeling, data visualization, and other digital content creation applications that used to be the exclusive domain of Unix-based systems.

OpenGL GRAPHICS CARDS
The powerful OpenGL graphics cards lurking within these workstations provide 3-D accelerator chips and sophisticated on-board geometry processors, designed to tackle high-end 3-D graphics.

10,000 RPM Ultra SCSI HARD DISK
All of the tested workstations came with fast 10,000-rpm Ultra-2 SCSI hard disks.

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PENTIUM III XEON WORKSTATIONS

Power

PC Magazine Labs tests six new dual 500-MHz Pentium III Xeon workstations to see which have the muscle to tackle midrange 3-D applications.

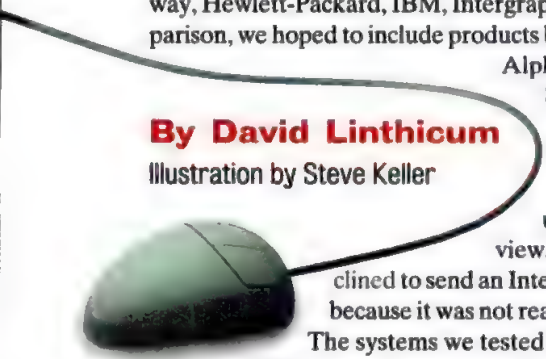
No longer content with conquering the low end of the graphics workstation market, workstation vendors have set their sights on users of midrange 3-D mechanical CAD, modeling, and digital content creation applications.

It was only a few years ago that the term *graphics workstation* meant a proprietary architecture from HP, IBM, Silicon Graphics, or Sun, based on a RISC microprocessor and running some variant of Unix. Only those systems, priced at $15,000 and up, could run the high-resolution 3-D workstation applications that would bring a traditional PC to its knees.

Over the past two years, multiprocessing Windows NT, advanced OpenGL graphics subsystems for PCs, and powerful Pentium II, III, and Xeon microprocessors have narrowed Intel's performance deficit with RISC-based Unix. At the same time, workstation applications have flocked to Windows NT, and obvious price/performance advantages (with workstations starting at under $5,000) have made the *x*86 workstation market explode. Last year, *x*86 workstations accounted for 56 percent of all workstations shipped—according to International Data Corp.

By David Linthicum

Illustration by Steve Keller



REVIEW CRITERIA

For this roundup, PC Magazine Labs acquired the latest high-performance 500-MHz Pentium III Xeon systems from six of the top Intel-based workstation vendors: Dell, Gateway, Hewlett-Packard, IBM, Intergraph, and SGI. For comparison, we hoped to include products based on the Compaq Alpha processor and Solaris-based products from Sun, but neither vendor was able to supply products in time for review. Compaq also declined to send an Intel-based SP700 system because it was not ready in time for testing. The systems we tested ranged in price from $7,999 to $12,314 and included dual Pentium III Xeon/500 CPUs with 512K of full-speed L2 cache, 256MB of system RAM, Windows NT, and a 8.6GB or 17.3GB hard disk. (The SGI unit had room for four CPUs, but we tested it with two.) We also asked for a 21-inch monitor and a graphics adapter with at least 31MB of frame buffer memory.

On each system, we ran PC Magazine Labs' suite of workstation application tests, which are based on the following popular 3-D MCAD and modeling, animation, and rendering packages: Softimage, LightWave 3D, Pro/Engineer, SolidWorks, and 3D Studio Max. Our tests emphasized 3-D graphics–intensive functions.

All of the systems were fast, but our biggest surprise was how similar the Windows NT workstation offerings were. All of the systems except the one from SGI had the same Intel 440GX motherboard chip set and a 10,000-rpm Seagate Ultra-2 SCSI hard disk. The Dell, IBM, and Intergraph units came with the same Intergraph Intense3D Wildcat 4000 graphics card. As a result, these systems had very similar performance results on all our application tests. The Gateway system fell behind because of a less capable 3Dlabs Oxygen GMX graphics card.

Then there was the Silicon Graphics 540 Visual Workstation. Standard PC workstation architecture puts dedicated graphics memory on a graphics card in an AGP slot. The SGI unit features a proprietary Unified Memory Architecture, which uses a Cobalt chip set to allocate CPU memory, frame buffer, z-buffer, and texture memory dynamically from the main system memory pool. Audio and video I/O ports are each directly connected to the chip set—as are graphics, networking, and FireWire I/O.

The data-streaming efficiency of the Cobalt chip set makes the Visual Workstation unbeatable when it comes to video and audio production and editing, which the system can do in real time without compressing and uncompressing video streams. Unfortunately, the lack of powerful geometry processing held the SGI system back on our basic 3-D application test suite.

We also ran a subset of application tests on a Dell Precision Workstation 410 with two Pentium III processors instead of a Pentium III Xeon. On the average, we found performance results to be only 7.3 percent lower with two Pentium IIIs than the same configuration with two Pentium III Xeons, with results ranging from a difference of 2.7 per-

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7100D: PV1046U-324J0

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Our Contributors: DAVID LINTHICUM is a distributed-computing expert. CADE METZ is a senior writer at *PC Magazine*. DAVID A. HARVEY is a freelance journalist and consultant. RICH FISCO was the project leader, and executive editor LEON ERLANGER was in charge of the story.

cent to 8.7 percent. We found similar results testing an SGI 320 Visual Workstation with two Pentium IIIs. If absolute top performance is not your priority, you can save anywhere from $200 (on the Dell) to $1,450 (on the IBM) by buying an equivalent system with two Pentium III's.

HP, IBM, Intergraph, and SGI have been strong in the workstation market for a long time. Dell is a relative newcomer but has managed to capture a large share of the workstation market with its direct sales model and volume product customization. Though the Dell Precision WorkStation 610 looks more like a corporate PC than a workstation, it has the combination of a low ($7,999 direct) price and top-notch performance—earning it an Editors' Choice designation.

XEON POWER

The Pentium III Xeon offers full-speed Level 2 cache amounts of 512K, 1MB, or 2MB compared with 512K of half-speed cache on the Pentium III. It also includes 70 new instructions called Streaming SIMD (single instruction, multiple data) Extensions (SSE). Though there is no huge performance leap from the Pentium II to the Pentium III for general-purpose applications, SSE can provide a significant advantage when used in 3-D graphics, video processing, and other complex multimedia applications that support it. None of the applications used on our test suite takes advantage of SSE yet, but you can expect some workstation applications to be optimized for SSE over the next several months.

Another advance is the 2X Accelerated Graphics Port (AGP 2X), which significantly improves graphics performance.

Troubleshooting, service, and support: The Dell and Gateway systems had the best combination of complete documentation and Web-based support, although none of the products earned a rating of *excellent*. Most vendors were penalized for not supplying troubleshooting software, such as Network Associates First Aid, or system recovery disks. We also took into account support issues, such as round-the-clock telephone support, Web support, and on-site service.

Access and upgrading: A tool-free case, easy access to expansion slots and memory, room for additional drives, good documentation, and a clutter-free interior earned the Dell a rating of *good*.

Performance: The Dell, HP, IBM, and Intergraph units were clustered together at the top of most test results—thus receiving a score here of *excellent*. The Gateway and SGI could not keep up because of weaknesses in their graphics subsystems.

	Troubleshooting, service, and support	Access and upgrading	Performance
EDITORS' CHOICE Dell Precision WorkStation 610	Good	Good	Excellent
Gateway E-5250	Good	Fair	Poor
HP Visualize X500	N/A	Fair	Excellent
IBM IntelliStation Z Pro	Fair	Fair	Excellent
Intergraph TDZ 2000 GX1	Fair	Fair	Excellent
Silicon Graphics 540 Visual Workstation	Fair	Fair	Fair

N/A—Not applicable. Hewlett Packard did not send us documentation in time for this roundup.

WHAT'S NEXT?

The Windows NT platform is poised to dominate the low end and midrange of the workstation market. Traditional Unix workstation vendors HP, IBM, Intergraph, and SGI are accepting Windows NT as the key to volume shipments in the future.

For now, Sun has chosen to continue developing its UltraSPARC technology. And PC-based workstations still cannot compete with the big SGI workstations that have 16, 32, or 64 CPUs with built-in multiple graphics-rendering systems. But we expect the new Intel/Corollary Profusion chip set (for eight-way server systems) to make its mark in the high-end workstation market.

For the time being, Unix will continue to dominate the high-end 3-D workstation market. But the best-value low-end and midrange 3-D graphical workstation is now the domain of Windows NT.

PC MAGAZINE EDITORS' HOT LINKS

www.pcmag.com/hotlinks
Visit our Web site for interactive views of the performance tests and features tables.

➤Multiprocessor Workstations using Intel Architecture
www.intel.com/business computing/wrkstn/multi/architecture.htm
This area of the massive Intel Web site covers the benefits of Intel-based multiprocessor workstations. It has links to several technology white papers and discusses multithreading and multitasking.

➤OpenGL
www.opengl.org/
This site offers lots of technical information about OpenGL. You can download drivers, register for OpenGL programming classes, and see which hardware components and software applications support OpenGL.

➤The OpenGL Web Site
http://reality.sgi.com/opengl/
If you have a question about OpenGL programming, go to this site. It has everything from OpenGL basics to rendering techniques. There's also information on how OpenGL works with Linux and OS/2.

➤3D Café
www.3dcafe.com
3D Café has it all for the 3-D graphics professional or hobbyist. Visit this site to find out about new products, chat with other graphic artists, or download fonts, textures, and plug-ins.

Dell Precision WorkStation 610

Dual Pentium III Xeon/500, Intense3D Wildcat 4000 graphics, 8.6GB Ultra-2 SCSI hard disk, 19.75" monitor. $7,999 direct. Round Rock, TX; 800-388-8542, 512-338-4400; www.dell.com.

Combining the accessibility of a Dell PC with workstation-level hardware, the Dell Precision WorkStation 610 performs on a par with the other leading systems reviewed here—the HP, IBM,

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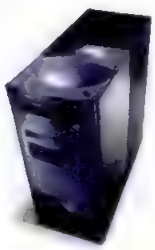

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*Estimated reseller price to end users. Actual prices may vary. Prices do not include monitors. Prices are for the following models: Netfinity 847631U, PC 300 6287-32U, IntelliStation 6893-62U, ThinkPad 390-90U. [1]A product is Year 2000 'Ready' if the product, when used in accordance with the associated documentation, is capable of correctly processing, providing and/or receiving date data within and between the 20th and 21st centuries, provided all other products (for example, software, hardware and firmware) used with the product properly exchange data with it. 'Ready' refers to the IBM hardware only, not to any software. IBM cannot take responsibility for the readiness of non-IBM software and other products, even if they are preinstalled or otherwise provided by IBM. You should contact these third parties directly to verify readiness, understand limitations, and/or look for updates to their products. If your computer is on at the beginning of the Year 2000, you should turn it off and then back on again once, or restart the operating system, to ensure the internal clock resets itself for the new century. To learn more about IBM PC products and the Year 2000, visit our Web site at *www.ibm.com/pc/year2000* or call 1 800 426-3395 and request fax document #10020. [2]MHz measures only microprocessor internal clock speed, not application performance. Many factors affect application performance. [3]GB means one billion bytes when referring to hard drive capacity; accessible capacity may vary. [4]Variable read rate. Actual playback speed will vary and is often less than the maximum possible. [5]Fire GL1 is a trademark of Diamond Multimedia Systems. [6]For terms and conditions, visit *www.ibm.com/pc/us/y_ibm* IBM and IBM product names are trademarks of International Business Machines Corporation. Intel, Intel Inside and Pentium are registered trademarks of Intel Corporation. ©1999 IBM Corp. All rights reserved.

IBM

Editors' Choice

• Dell Precision WorkStation 610

PC MAGAZINE EDITORS' CHOICE

Four of the six workstations in this roundup—the Dell, HP, IBM, and Intergraph units—had the same or similar motherboard chip sets, hard disks, and graphics cards and thus posted very similar performance results. All four of the systems are excellent products. The Dell Precision WorkStation 610 ($7,999 direct) was the least expensive of the four. Add a case design with excellent serviceability and access, as well as Dell's top-notch service and support, and you have a winner.

Our honorable mention, the Silicon Graphics 540 Visual Workstation, is in a class by itself. Silicon Graphics, a top Unix workstation vendor, leads its foray into the world of Intel and Windows NT with a workstation based on a proprietary memory and graphics subsystem. Unfortunately, the SGI could not compete with the four top systems on our suite of application tests.

When it comes to producing and editing streaming video, however, the Visual Workstation is a screamer. With no additional hardware, it can edit streaming video in real time without resorting to compression. The Visual Workstation handled a filter application in 1 minute, while an Intel-based workstation using a PCI-based video capture card took 7 minutes.

The 3Dlabs Oxygen GMX graphics card in the Gateway E-5250 left its performance below the top four performers in the roundup.

and Intergraph models—while offering a chassis conducive to upgrades and repairs and a far lower price. Though Dell didn't cut its teeth in this market and sells only Intel-based systems, this, the company's foremost workstation, is a very capable competitor with the market's more traditional workstations and earns our Editors' Choice.

Like the Gateway E-5250, the Precision lacks the rugged case of a classic workstation, but it's the easiest to service of all the systems we tested. Its off-white mini-tower is based on a chassis design from the Dell OptiPlex desktop line, one of the first PC lines to offer components that can be removed without tools. Though the case is lockable, one of the machine's side panels easily pops off to reveal a well-organized interior, where four bus slots are unobstructed.

By removing the Precision's front panel, you also gain access to four bays meant for external drives. All such drives can be inserted and extracted without tools. Furthermore, a metal handle in front of the system provides access to a convenient cage of internal drive bays, while the power supply can be rotated away from the motherboard to reveal four standard DIMM slots.

Using the same Intense3D Wildcat 4000 graphics card and 10,000-rpm Seagate Ultra-2 SCSI hard disk as the IBM and Intergraph models, the Precision had application performance that was in line with those systems' and with the HP's. It managed top scores on the LightWave 3D test and also scored equally well on the SolidWorks I/O Intensive tests and 3D Studio Max Render and Animation tests. The unit's dual-processor scores were in line with those of the IBM, Intergraph, and HP systems.

Dell's service and support offerings are as impressive as its machine—particularly the help tools and documentation, which can be customized for your configuration, on its Web site. The company also ships the Precision with OpenManage DMI software—which will be updated this spring—and a three-year-parts, one-year-labor warranty.—*Cade Metz*

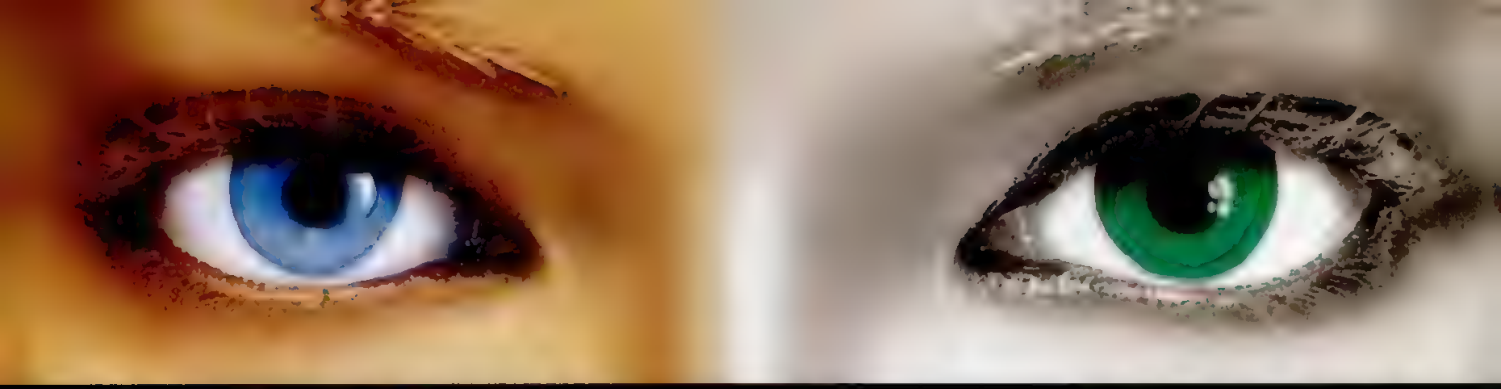
Swing-away power supplies and slide-out drive bays are just two of the reasons this Dell workstation is our Editors' Choice.

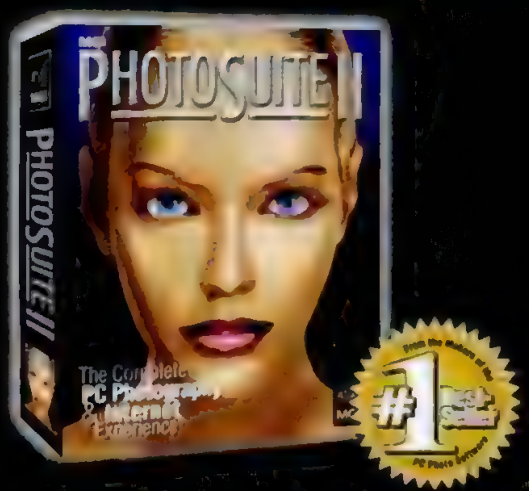
Gateway E-5250

Dual Pentium III Xeon/500, 3Dlabs Oxygen GMX graphics card, 17.3GB Ultra-2 SCSI hard disk, 19.75" monitor. $7,887 direct. North Sioux City, SD; 800-315-2536, 605-232-2000; www.gateway.com.

● The $7,887 price tag and 17.3GB hard disk of this modest work-station are hardly enough to recommend it. The Dell Precision WorkStation 610 reviewed here is only $112 more expensive than the Gateway E-5250 yet is significantly faster and much easier to service. Like Dell, Gateway is a PC company that has moved into the workstation market. Though this machine represents the high end of Gateway's workstation line, it's several steps behind the competition.

From the outside, the E-5250 is inconspicuous. Like the Dell machine, it is not as rugged or aesthetically appealing as the more expensive models from HP, IBM, Intergraph, and SGI. It incorporates both an LS-120 drive and a floppy disk drive but otherwise resembles a common PC tower with an attached pair of external speakers. Removing a few thumbscrews and sliding off the system's side panel exposes a seemingly disorganized, cramped interior. Because Ethernet, audio, SCSI, and graphics reside on expansion cards, the machine's three available bus slots (one shared, two PCI) are relatively difficult to access. The same is true of the four available inter-





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MGI PhotoSuite #1 Best Seller statement based on Dataquest report June 16, 1998. MGI VideoWave #1 Best Seller based on PC Data Reports May–December 1998.

nal bays and—to a lesser extent—the two open external bays. Unlike most other vendors reviewed here, the E-5250 houses all 256MB of its system memory on a single DIMM, leaving three slots open for expansion.

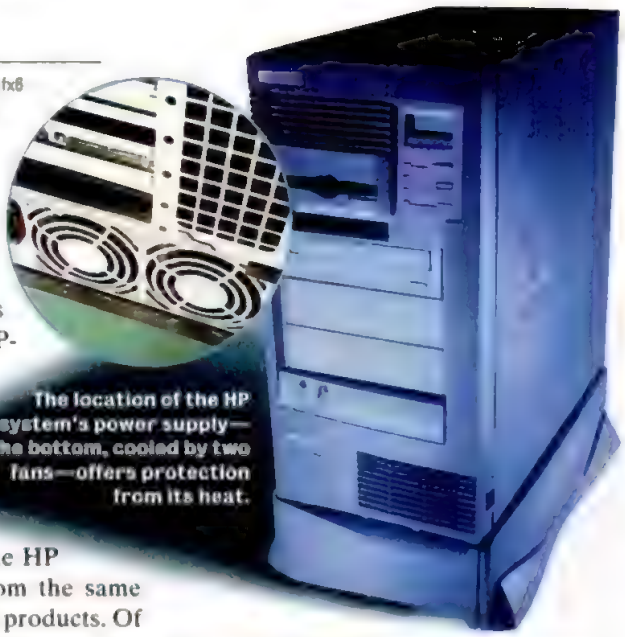
Primarily because of its 3Dlabs Oxygen GMX AGP graphics card, which is less costly and less capable than the Intense3D Wildcat 4000 cards used by the Dell, IBM, and Integraph machines and the HP Visualize fx6 cord used in the HP workstation, the E-5250 brought up the rear during benchmark testing, turning in many of the poorest application scores and the lowest Winstone score. It slightly outperformed the Silicon Graphics S40 Visual Workstation on our SolidWorks and LightWave 3D tests but fell far behind on the graphics-intensive Softimage GL Render and 3D Studio Max Render tests.

Though this machine isn't as well ventilated as the HP or the SGI model, the E-5250 loads Intel's LANDesk Client Manager software as a means of detecting high temperatures and other internal hardware problems. The company also backs the machine with several other means of support, including a three-year warranty, extensive documentation, several help tools, and a Web page filled with troubleshooting tools, software updates, and bug fixes. The E-5250's Internet-based support, while not as customizable as the Precision's, is among the market leaders.—*CM*

The inside of the Gateway E-5250's case is a little more cluttered and disorganized than most.

HP Visualize X500

Dual Pentium III Xeon/500, HP Visualize fx6 graphics card, 8.6GB Ultra-2 SCSI hard disk, 19.75" monitor. $12,314 list. Palo Alto, CA; 800 322-4772, 415-857-1501, www.hp.com



The location of the HP system's power supply—on the bottom, cooled by two fans—offers protection from its heat.

● Hewlett-Packard has a long history in the graphics workstation market with systems based on its PA-RISC processor and HP-UX, HP's implementation of Unix. Until now, Intel-based workstations have come out of HP's Kayak PC division, but the HP Visualize X500 comes from the same division as HP's PA-RISC products. Of the four fastest workstations in our roundup, the HP Visualize X500 is the only one that doesn't use an Intense3D Wildcat 4000 graphics solution, relying instead on an HP-built Visualize fx6 card. It does, however, use 10,000-rpm Seagate Ultra-2 SCSI hard disk, as does every machine reviewed here, and virtually the same processor subsystem as all but the SGI, producing benchmark test scores on a par with performance leaders from Dell, IBM, and Intergraph. The machine is a bit difficult to service, and even if you consider a street price 10 to 15 percent less than HP's list price (HP wouldn't quote a street price), the Visualize is more than a thousand dollars more expensive than the other systems we tested.

The Visualize's frame is thick and sturdy, and its interior has been carefully designed to avoid overheating. Two dedicated fans are used to cool the power supply, which sits in its own compartment at the bottom of the system, separate from the rest of the hardware. We also liked the front status display, which provides BIOS Post information and error messages, as well as the ability to perform a soft power-down by hitting the power button.

The system isn't as easy to repair or upgrade as it could be. Its open memory slots (two DIMMs) and open bus slots (only one shared and one PCI) are difficult to reach, and its open drive bays can't be accessed without a screwdriver. All extant drives are fastened down with thumbscrews and slide out somewhat easily—though not nearly as easily as drives used by the Dell model.

On the evidence of our benchmark tests, the HP Visualize fx6 graphics card compares well with the Intense3D Wildcat 4000 card used by our roundup's three other leading workstations. The HP's scores on our ProE and Softimage tests were the best of the group, and many of the other application scores were in line with those of the Dell and IBM machines.

We didn't receive any documentation or management software, but HP plans to ship the system with full documentation and HP's TopTools 4.2. HP offers a warranty of three years on parts and one year on labor and provides good support for the system over the Web.—*CM*

IBM IntelliStation Z Pro

Dual Pentium III Xeon/500, Intense3D Wildcat 4000 graphics, 8.6 GB Ultra-2 SCSI hard disk, 19.8" monitor. $9,370 street. Research Triangle Park, NC; 800-426-2968; www.ibm.com.

● IBM has been in the workstation market for many years, offering the RS/6000 series based on its Power 3 processor and running AIX, IBM's brand of Unix. The Intel-based IBM IntelliStation Z Pro's

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*Bandwidth based on graphics to main memory **I/O bandwidth as compared to 32-bit PCI. †For information on the 1999 availability of the Silicon Graphics 540 workstation, please call 1 888 SGI-4289. ††Requires additional software under Windows NT Workstation 4.0. Prices quoted are for U.S. only. All prices subject to change.

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BENCHMARK TESTS

3-D Workstations

The Dell, HP, IBM, and Intergraph systems led the pack. The Gateway was burdened with a slower graphics card than the top three. The SGI's greatest strength is video production.

We chose a suite of performance tests based on some of the most popular workstation applications plus our standard CPUMark 99 and Winstone 99 benchmark tests.

Parametric Technology's Pro/Engineer release 20.0 is the leading mechanical CAD (MCAD) software package. The **Pro/Engineer** tests, which we obtained from Standard Performance Evaluation Corp. (SPEC), measure a typical user session with the application. The **Wireframe Composite** test uses a model consisting of 370,00 polygons and stresses the graphics OpenGL hardware and geometry engines. The three systems based on the Intergraph Intense3D Wildcat 4000 graphics card (the Dell Precision WorkStation 610, IBM IntelliStation Z Pro, and Intergraph TDZ 2000 GX1) all scored very closely, with the Intergraph edging out the others. The HP Visualize X500 was just slightly behind the Wildcat-based systems. The Gateway E-5250, using a 3Dlabs Oxygen GMX card with a Glint Gamma geometry processor, was about 10 percent behind the HP machine.

The **Shaded Composite** test adds shading to the model and tests pixel fill rate and OpenGL capabilities. The HP beat the three Wildcat-based systems by more than 30 percent. The **Subassembly Composite** test uses an image with far fewer polygons. The HP and Intergraph models ended in a virtual tie. The **Other Composite** test measures geometry and pixel-fill rate, with the emphasis on geometry processing. Again, the three Wildcat systems nearly tied, but the HP beat them by more than 18 percent. The **Overall Composite** score is a geometric mean of all the tests. The HP unit came in first, showing the best balance of geometry, pixel fill rate and OpenGL processing.

SolidWorks 98, from SolidWorks Corp., is a leading Windows-based 3-D mechanical design package. The **SolidWorks** test, also obtained from SPEC, returns graphics, CPU, I/O, and overall scores. The **Graphics** test uses two images, one with a large (about 276,000) polygon count and the other with a medium count. The Intergraph bested the second-place HP model by nearly 4 percent, and the third-place Dell unit (with the Intergraph Wildcat 4000 graphics card) by 15 percent. A weakness in the SGI 540's graphics capabilities is evident here: It was more than 67 percent off the pace set by the Intergraph, probably because of a relatively slow geometry processor.

On the **CPU Intensive** test, the Gateway and the SGI were about 25 percent behind the others. Since both units have weaker graphics subsystems, this indicates that the test includes some graphics functions.

The **I/O Intensive** test loads and saves files, mainly exercising the hard disk subsystem. The Gateway and SGI systems came in 28 percent and 34 percent behind the other four systems respectively, indicating a graphics component to the test.

Avid Technology's Softimage/3D Extreme, Version 3.8 SP1 is a high-end 3-D animation product. The **Softimage 3D Extreme GL Render** test is a measure of the OpenGL graphics hardware's ability to render an image; the **Mental Ray Renderer** test uses the same image but does the process all in software, thereby stressing the floating-point capabilities of the processor. On both tests the HP took first place. The Oxygen GMX card in the Gateway unit could not keep up, and the SGI 540 fell behind too.

3D Studio Max R2.5, from Kinetix, is a 3-D modeling and animation package. We present four of the eleven tests in our **3D Studio Max** test suite. The HP workstation was unable to perform these tests. Kinetix created the tests and is aware that the tests do

High scores are best.
Bold type denotes first place among reviewed units.
denotes Editors' Choice.

	ZD Business Winstone 99 Score	CPUMark 99 Score	Dual-Processor Inspection Percent
Dell Precision WorkStation 610	29.5	41.6	67.5
Gateway E-5250	27.3	41.3	65.3
HP Visualize X500	29.1	41.4	67.6
IBM IntelliStation Z Pro	28.6	41.4	69.1
Intergraph TDZ 2000 GX1	29.0	**41.7**	65.0
Silicon Graphics 540	**31.5**	40.0	**71.9**
Silicon Graphics 320*	30.3	38.3	N/A

* A dual-Pentium III/500 system with 256MB of RAM, running Windows NT, reported for comparison

BETTER ▶

◀ **Our new CPUMark 99 test measures the performance of the CPU, caches, and main memory. Except for the SGI 540, all systems had the identical processor, memory, and chip set. The SGI's score was about 4 percent lower than the rest, pointing to possible problems with its proprietary memory subsystem.**

▼ **The HP Visualize X500, based on HP's Visualize fx6 graphics card came out ahead on four out of the five Pro/Engineer tests. The Gateway E-5250, using a 3Dlabs Oxygen GMX card with a Glint Gamma geometry processor, was anywhere from 10 percent to more than 50 percent behind the HP model.**

High scores are best.
Bold type denotes first place among reviewed units.
denotes Editors' Choice

	Pro/Engineer Overall Composite (geometric mean)	Wireframe Composite	Shaded Composite	Subassembly Composite	Other Composite	SolidWorks Geometric Mean	Graphics	CPU Intensive	I/O Intensive
Dell Precision WorkStation 610	3.82	4.65	3.86	4.19	4.09	2.80	3.32	2.04	2.32
Gateway E-5250	2.40	4.04	2.79	1.82	3.03	2.06	2.30	1.66	1.82
HP Visualize X500	**4.14**	4.48	**5.10**	**4.24**	**4.86**	2.96	3.69	2.01	2.23
IBM IntelliStation Z Pro	3.79	4.57	3.87	4.18	4.08	2.73	3.23	2.01	2.22
Intergraph TDZ 2000 GX1	3.78	**4.68**	3.87	4.22	4.08	**3.03**	**3.82**	2.04	2.23
Silicon Graphics 540	3.28	3.83	3.87	3.22	3.95	2.02	2.29	1.63	1.73
Silicon Graphics 320*	N/A	N/A	N/A	N/A	N/A	1.92	2.15	1.57	1.68

* A dual Pentium III/500 system with 256MB of RAM, running Windows NT, reported for comparison N/A—Not Applicable. The SGI 320 could not perform this test

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BENCHMARK TESTS

not run on the Visualize fx6 graphics card in the HP. The next revision of the tests should solve the problem. **Benchmark 3** exercises a graphics card's ability to cull objects from a scene. The Dell model edged out a closely packed field, while the Gateway fell way behind. **Benchmark 8** uses a scene with over 320,000 polygons to test a graphics card's geometry processing. Again, the Dell machine came out on top and the Gateway lagged, but the Silicon Graphic's performance was noticeably slow. Though it shows a deficiency in its geometry processing, the SGI system came in first by a significant margin (more than 28 percent), ahead of the Intergraph, on **Benchmark 9**, which tests a card's pixel fill engine. **Benchmark 10** tests both the geometry engine of the graphics card and the floating-point capabilities of the processor. Since the SGI did poorly on most tests previously, it is no surprise that it came in last on this test as well. We also rendered an AVI clip using raw video output (results not shown). All systems handled this task well, with less than 1 percent separating the performance of the first-place Dell and the last-place Gateway.

NewTek's LightWave 3D, Version 5.6, is a 3-D animation program that produces special effects for film and games. The **LightWave 3D Render** test combines 2-D and 3-D functionality. The image consists of 56,000 polygons on a 2-D background. If a card has trouble handling combined 2-D and 3-D graphics, it won't do well on this test. Again, the SGI's graphics subsystem was unable to keep up with the other systems.

Though SGI markets its new Windows NT systems toward all facets of the workstation market, the company emphasizes the system's streaming video capabilities—useful for video production, video editing, and special effects. To test these capabilities, we enlisted the help of Jamie Carr, CEO of In Sync, the makers of Speed Razor 4.5.

We used a professional video capture card, the DigiSuite from Matrox, and Speed Razor for NT ($5,000) for all the workstations besides the SGI. The DigiSuite is a $10,000 card, but the SGI 540 needed only the version of Speed Razor made for it (about $900), because it has the video hardware built in. The video test applies a simple gray-scale effect to a color video clip in real time via software. The SGI, with its video-streaming capabilities, was able to handle a gray-scale filter effect in 1 minute, compared with the 7 minutes it took a PC using the PCI video capture card—showing a big advantage for the SGI over the typical PC workstation in this area. For about $10,000, the SGI offers the video performance of RISC workstations costing four times as much.

In order to compare processors, we also tested an SGI 320 and Dell Precision WorkStation 410. Both use Pentium III processors instead of Pentium III Xeon processors but otherwise have all the same components as their Pentium III Xeon counterparts. On most of the tests, the performance difference was 1 to 6 percent for the SGI systems, 3 to 9 percent for the two Dell systems.

To see how a workstation with a high-end OpenGL graphics card compares with a regular PC in performance, we took a Micron Millennia Max 500 with one 500-MHz Pentium III CPU and beefed it up to fit a normal workstation configuration: We put in 256MB of memory and loaded Windows NT. We then ran our Ziff-Davis benchmark tests on it as well as the SolidWorks tests. The workstation applications we ran told the story. Equipped with a Diamond Viper V550 with 16MB of frame-buffer memory, and based on the nVidia TNT chip, which can handle OpenGL, the PC was no match for the big-iron workstations we had just tested. The graphics composite test was the most telling: The Micron was not even half as fast as the leading Intergraph system. It was a bit closer on the CPU and I/O tests, but still not in the same league.

Generally, you would need to add an expensive graphics card, a SCSI hard disk, and lots of memory to get a PC up to the power of a workstation. At that point, you are near to or at the same cost as these workstations. But the last ingredient of a workstation is still missing: You don't get the vendor's assurance that the professional software you are using has been qualified to run on your system, which is standard with workstations and the applications mentioned below.

Our new **ZD CPUMark 99** test measures the performance of the CPU, caches, and main memory. Except for the SGI 540, all systems had the identical CPU, memory, and chip set. The CPUMark scores show the SGI 540 to be slightly (about 4 percent) slower than the rest. We believe this points to possible problems with its memory subsystem, specifically burst read/write cycle startup latencies dealing with the CPU-intensive instruction mixes of typical business applications.

We used the **ZD Business Winstone 99** test suite to see how a workstation handles typical business applications. SGI bested the field on our 2-D business benchmark tests. It scored 15 percent better than the slowest system (the Gateway E-5350) and almost 7 percent better than the nearest competitor, the Dell system. Here, the graphics subsystem's 2-D performance makes the difference.

The **Dual-Processor Inspection** tests in the Winstone 99 program measure the performance achieved from adding a second processor to the system. The score improvement ranged from 65 to 69 percent. Please see *www.pcmag.com/features/3dworkstations99* for more information on how we tested.—*Analysis written by Rich Fisco*

▼ With its excellent pixel-fill engine, the SGI fared well in the **3D StudioMax** Benchmark 9 test, leading the pack by more than 28 percent, but fell behind again on other tests. The SGI really shines when its streaming-video capabilities are put to the test. A video-editing test (not shown) uses Speed Razor SE to apply a simple gray-scale effect to a color video clip. On the SGI 540, the 1-minute clip took 1 minute to come out on the monitor. On the PC using a Matrox video capture card, it took 7 minutes (6 to capture, render, and decompress the video, plus 1 minute to play it).

Low scores are best.
Bold type denotes first place among reviewed units.
denotes Editors' Choice.

	Softimage 3D Extreme		3D StudioMax				LightWave 3D
	GL Render (seconds)	Mental Ray Renderer (min:sec)	Render (min:sec)	Benchmark 3 (milliseconds)	Benchmark 8 (milliseconds)	Benchmark 9 (milliseconds)	Benchmark 10 (milliseconds)	Render (min:sec)
Dell Precision WorkStation 610	32.2	**4:14**	**7:20**	3,687	**22,914**	3,493	**10,735**	**2:13**
Gateway E-5250	45.3	4:20	7:25	6,914	30,805	7,562	22,196	2:40
HP Visualize X500	**30.0**	4:15	7:22	N/A	N/A	N/A	N/A	2:20
IBM IntelliStation Z Pro	31.7	**4:14**	7:23	3,859	23,093	3,476	10,789	2:26
Intergraph TDZ 2000 GX1	32.1	4:15	7:21	**3,688**	22,977	**3,414**	10,891	2:30
Silicon Graphics 540	34.1	4:38	7:24	**3,680**	39,240	**2,435**	35,450	3:30
Silicon Graphics 320*	34.8	4:43	7:38	3,785	41,535	2,365	35,060	3:33

* A dual Pentium III/500 system with 256MB of RAM, running Windows NT, reported for comparison. N/A—Not applicable. The HP workstation could not perform this test.

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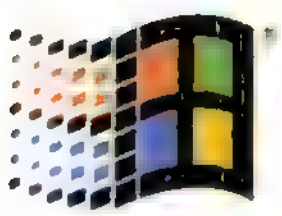

WINDOWS 20

Microsoft Windows NT Workstation 4.0 is now available with Service Pack 4, which includes Y2K and Euro updates. For Year 2000 information regarding Microsoft products see www.microsoft.com/year2000/.

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molded black plastic may not match the futuristic enclosures of the Intergraph and SGI workstations reviewed here, but what lies inside is an excellent mix of value, manageability features, and truly useful bundled software. What lies outside is the best monitor of the bunch and above-average online support.

The IntelliStation's case is sturdy, but getting inside takes a little more time and effort than the well-designed Dell and Intergraph cases do. Slide off the side panel, remove a metal brace and one screw, and finally a drive cage can swing free. The interior feels cluttered and contains too few power connectors to load up a full complement of peripherals.

The four DIMM slots (three free) are easily accessible, located just above the expansion slots. There are three free PCI slots and one free PCI/ISA slot. The motherboard and case are loaded with manageability features: A sensor guards the opening and closing of the case, the network adapter supports Wake on LAN, and ECC memory is in use. The thermal subsystem is well designed. Three fans pull air from the case—one near the CPUs, one on the power supply, and one in front of the PCI slots. To assure that the system stays thermally correct, heat sensors are linked to DMI alerts which can then be linked into any desktop management package.

A large metal brace runs the width of the IBM chassis, adding support but preventing easy access to expansion slots.

The IntelliStation was neck and neck with top performers Dell, HP, and Intergraph on all of the application and Winstone tests and bested the field on the Dual-Processor Inspection test.

The extras here are all first-rate. The 19.8-inch IBM P202 monitor was dazzling—easily the best we saw. IBM's bundle of software includes everything from Lotus SmartSuite to a comprehensive set of manageability, networking, and diagnostic software. Online support is excellent: A set of Web pages installed onto your computer at the factory lets you link up with online IntelliStation support, where you can set up a custom profile by exact machine type and find support bulletins, FAQs, and files. *—David A. Harvey*

SUMMARY OF FEATURES

3-D Workstations: System Features

■ YES □ NO	Dell Precision WorkStation 610	Gateway E-5250	HP Visualize X500	IBM IntelliStation Z Pro	Intergraph TDZ 2000 GX1	Silicon Graphics 540 Visual Workstation
Price of tested configuration	$7,999 direct	$7,887 direct	$12,314 list	$9,370 street	$9,995 direct	$9,761 direct
Installed/maximum SDRAM	256MB / 2GB	256MB / 2GB	256MB / 2GB	256MB / 2GB	256MB / 2GB	256MB / 2GB
Installed pipelined-burst L2 cache	512K	512K	512K	512K	512K	512K
Memory packaging	DIMMs	DIMMs	DIMMs	DIMMs	DIMMs	Proprietary
Motherboard manufacturer	Dell	Intel	HP	IBM	Intel	SGI
Chip set	Intel 440GX	Intel 440GX	Intel 440GX	Intel 440GX	Intel 440GX	Silicon Graphics Cobalt
BIOS version	Dell X-25	Phoenix 4.0 Release 6.0	Phoenix HO.11.03	IBM NVJT41	Phoenix 1.00.25	Silicon Graphics PROM
Flash BIOS	■	■	■	■	■	□
Hard disk (Ultra-2 SCSI)	8.6GB Seagate ST39102LW	17.3GB Seagate ST118202LW	8.6GB Seagate ST39102LW	8.6GB Seagate ST39102LW	8.6GB Seagate ST39102LW	8.6GB Seagate ST39102LW
Maximum disk storage supported	54.6GB	27GB	36GB	63.7GB	72GB	54GB
Disk controller	Adaptec AIC-7890	Adaptec 2940U2	Adaptec 2940U2	Adaptec 2940U2W	Symbios Logic SYM89510	Qlogic ISP 1080
CD-ROM drive	NEC 465	Plextor PX-32TSi	Hitachi CDR-8430	Sony CDU701-F3	Sony CDU611	Teac CD-532E
Minimum/maximum speed	14X / 32X	14X / 32X	14X / 32X	17X / 40X	14X / 32X	14X / 32X
Network adapter (10/100 Mbps)	3Com 3C900B	3Com Fast Etherlink XL	HP Night-Director/100	Intel 82558	Intel 82558	Intel 82558
Network adapter interface	Motherboard PCI	PCI card	PCI Card	Motherboard PCI	Motherboard PCI	Motherboard PCI
Monitor	Dell M1110	Gateway VX1100	HP P1100	IBM P202	Intergraph 21sd95	SGI GDM-5021PT
Viewable diagonal size (inches)	19.8	19.8	19.8	19.8	19.9	19.8
Expansion-bus slots	4 PCI, 1 ISA/PCI, 1 AGP	5 PCI, 1 ISA/PCI, 1 AGP	4 PCI 1 ISA/PCI, 1 AGP	5 PCI, 1 ISA/PCI, 1 AGP	5 PCI, 1 ISA/PCI 1 AGP	6 PCI
Front-accessible drive bays (5.25", 3.5")	3 / 1	4 / 1	3 / 2	2 / 2	3 / 1	1 / 2
Internal drive bays (5.25" / 3.5")	0 / 4	0 / 3	0 / 2	0 / 4	0 / 3	0 / 3
Power supply	330 watts	300 watts	350 watts	330 watts	300 watts	587 watts
Parallel/serial ports	1 / 2	1 / 2	1 / 2	2 / 1	1 / 2	1 / 1
USB/SCSI ports	2 / 1	2 / 1	2 / 1	2 / 1	2 / 1	2 / 0
Live 24-hour, 7-day toll-free technical support	■	■	□	■	■	□
Standard warranty on parts/labor	3 years/ 1 year	3 years/ 3 years	3 years/ 1 year	3 years/ 1 year	3 years/ 1 year	3 years/ 3 years
On-site service charge for 1 year	Included	Included	Included	Included	Included	Included
Guaranteed 24-hour turnaround for parts replacement	□	□	Optional	□	■	■

Intergraph TDZ 2000 GX1

Dual Pentium III Xeon/500, Intense3D Wildcat 4000 graphics, 8.6GB Ultra-2 SCSI hard disk, 19.9" monitor. $9,995 direct. Huntsville, AL; 800-763-0242, 256-730-5441; www.intergraph.com.

● Intergraph designed the Intense3D Wildcat 4000—the graphics card used by the Dell and IBM workstations we tested—and the Intergraph TDZ 2000 GX1 essentially matches those machines' performance, as well as that of the HP Visualize X500. The TDZ offers a unique multimedia keyboard and a sturdy, acces-

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SUMMARY OF FEATURES — See www.pcmag.com for interactive views

3-D Workstations: Graphics Features

2-D graphics chip set Often separate integrated circuits are used for displaying 2-D and 3-D graphics, and such graphics cards have separate 2-D and 3-D accelerator chips. Others have the two chips combined into one.

On-the-fly resolution adjustment and refresh rate and **On-the-fly color depth adjustment** take effect without rebooting or restarting the operating system's graphical interface

Color calibration of RGB value Some graphics card utilities let you adjust the color value of the signal output from the graphics card to a setting optimized for the monitor

Geometry processor chip For faster rendering, geometry processing can be off-loaded to a specialized integrated circuit

Frame buffer memory The more frame buffer memory the graphics card has, the larger the screen resolution and the higher the color depth it supports. 16MB is required for displaying 1,600-by-1,280 at true color in double-buffer mode

Texture memory The texture memory is used for rendering the texture locally on the graphics card, freeing up the system's I/O bus

Z-buffer memory The Z-buffer memory stores the depth value of each 3-D object, which determines whether the object is visible or hidden behind another object

Accelerated double-buffered color depths Some graphics systems divide the frame buffer memory in two and buffer consecutive frames

Bilinear filtering calculates the color value of a texel (texture element) applied to a pixel by taking the weighted average of four adjacent texture elements—producing a smoother, more realistic image

MIP mapping For optimal performance in realistic 3-D screen display, textures of various levels of detail can be applied to objects in a scene, depending on each object's distance from the viewpoint

Trilinear MIP mapping Some systems perform linear filtering between texture maps of varying levels of detail, smoothing the edge transitions between the different-resolution textures. Also, within a particular texture map, linear filtering is used to apply texture data to an object's pixels. This method produces natural-looking 3-D surfaces

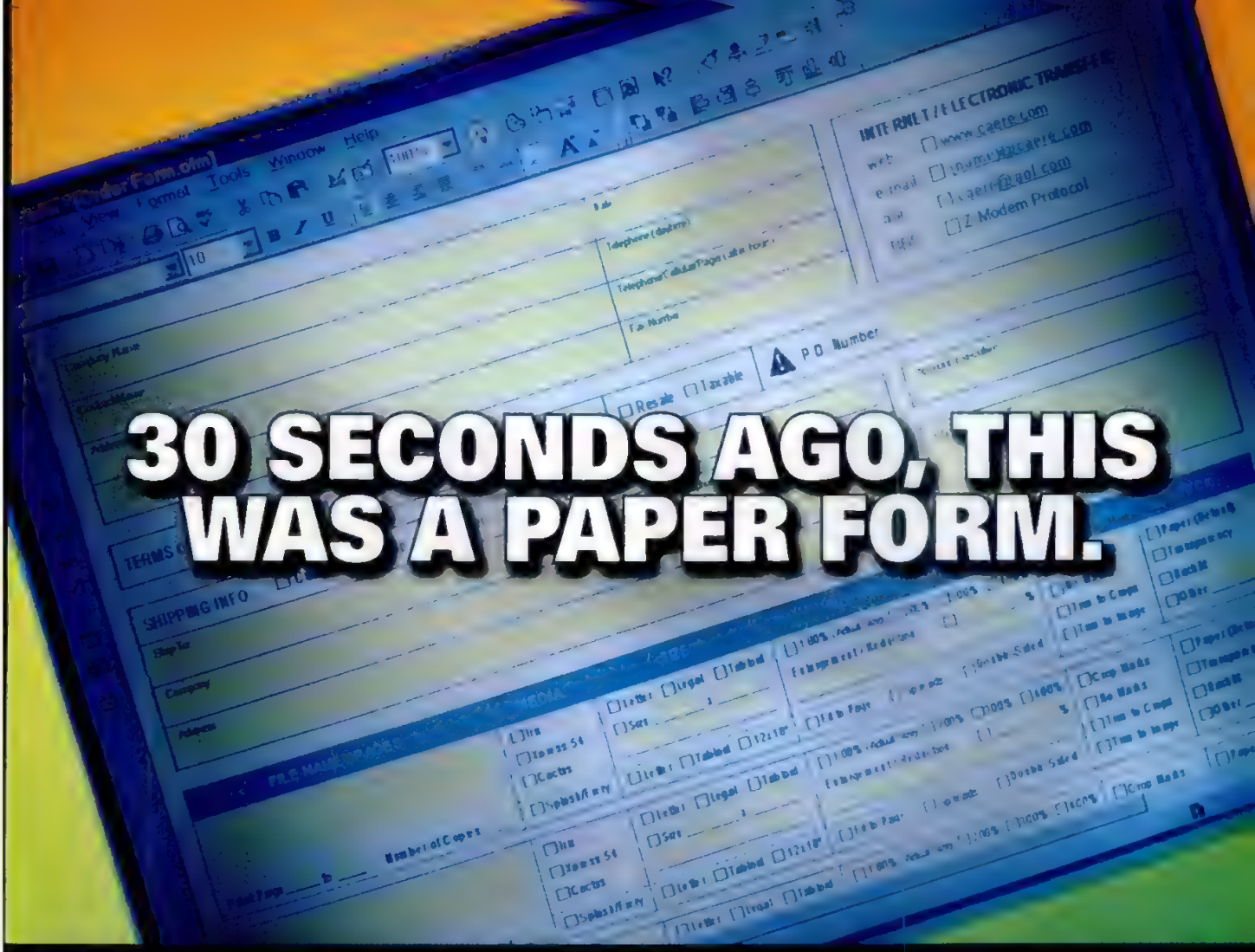
Perspective texture correction For a more accurate sense of distance, texture images are distorted relative to the point of origin

Anisotropic texture memory When an object is tilted in respect to the view plane, bilinear and trilinear texture filtering do not always yield best results. Both methods assume that the texture elements applied to the image surface are round, but the projection of texels onto the pixels needs to be elliptical. Anisotropic texture filtering accounts for this odd positioning of objects and produces images of superior realism

■ YES ☐ NO

	Dell Precision WorkStation 610	Gateway E-5250	HP Visualize X500	IBM IntelliStation Z Pro	Intergraph TDZ 2000 GX1	Silicon Graphics 540 Visual Workstation
Graphics card	Intergraph Intense3D Wildcat 4000	3Dlabs Oxygen GMX	HP Visualize fx6	Intergraph Intense3D Wildcat 4000	Intergraph Intense3D Wildcat 4000	Silicon Graphics Cobalt
2-D graphics chip set	Intense3D	3Dlabs Oxygen GMX	HP Visualize fx6	Intense3D	Intense3D	Silicon Graphics Cobalt
DISPLAY CHARACTERISTICS						
Maximum number of colors/refresh rate						
1,600 x 1,280	N/A	16.7 million/ 75 Hz	16.7 million/ 75 Hz	N/A	N/A	16.7 million/ 75 Hz
1,280 x 1,024	16.7 million/ 85 Hz	16.7 million/ 85 Hz	16.7 million/ 85 Hz	16.7 million/ 85 Hz	16.7 million/ 85 Hz	16.7 million/ 85 Hz
1,152 x 864	16.7 million/ 85 Hz	N/A	N/A	16.7 million/ 85 Hz	16.7 million/ 85 Hz	N/A
1,024 x 768	16.7 million/ 122 Hz	16.7 million/ 85 Hz	16.7 million/ 120 Hz	16.7 million/ 122 Hz	16.7 million/ 122 Hz	16.7 million/ 120 Hz
800 x 600	16.7 million/ 153 Hz	16.7 million/ 85 Hz	16.7 million/ 120 Hz	16.7 million/ 153 Hz	16.7 million/ 153 Hz	16.7 million/ 120 Hz
On-the-fly resolution adjustment and refresh rate	■	■	■	■	■	■
On-the-fly color depth adjustment	■	■	■	■	■	■
Virtual-desktop features						
Panning	☐	☐	☐	☐	☐	☐
Zoom	☐	☐	☐	☐	☐	☐
Auto-centering	☐	☐	☐	☐	☐	☐
Color calibration of RGB value	■	☐	☐	■	☐	☐
Easy access to graphics utilities	■	■	■	■	■	■
3-D FEATURES						
3-D rendering chip	Intense3D Wildcat 4000	3Dlabs Gamma MX	HP Visualize fx6	Intense3D Wildcat 4000	Intense3D Wildcat 4000	Silicon Graphics Cobalt
Geometry processor chip	Wildcat Geometry Accelerator	Gamma Gamma	HP Visualize fx6	Wildcat Geometry Accelerator	Wildcat Geometry Accelerator	Silicon Graphics Cobalt
Frame buffer memory (installed/maximum)	16MB SDRAM/ 16MB	16MB VRAM/ 16MB	18MB SGRAM/ 18MB	16MB SDRAM/ 16MB	16MB SDRAM/ 16MB	Varies
Texture memory (installed/maximum)	64MB SDRAM/ 64MB	80MB EDO DRAM/ 80MB	32MB SDRAM/ 32MB	64MB SDRAM/ 64MB	64MB SDRAM/ 64MB	Varies
Z-buffer memory	Shared with frame buffer and texture memory	Shared with frame buffer memory	Shared with frame buffer memory	Shared with frame buffer and texture memory	Shared with frame buffer and texture memory	Varies
Z-buffer depths supported	32-bit	32-bit	24-bit	32-bit	24-bit	32-bit
Accelerated double-buffered color depths						
1,600 x 1,280	N/A	32-bit	12-bit	32-bit	N/A	32-bit
1,280 x 1,024	24-bit	32-bit	24-bit	24-bit	24-bit	32-bit
1,024 x 768	24-bit	32-bit	24-bit	24-bit	24-bit	32-bit
800 x 600	24-bit	32-bit	24-bit	24-bit	24-bit	32-bit
Supports most recent version of OpenGL	■	■	■	■	■	■
Other APIs supported	DirectDraw, Direct3D, RenderGL, 2D GDI	None	DirectDraw, Heidi	DirectDraw, Direct3D, RenderGL, 2D GDI	DirectDraw, Direct3D, RenderGL, 2D GDI	DirectDraw, DirectX, Quicktime, and 2D GDI
3-D CHIP SET FEATURES						
Bilinear filtering/MIP mapping	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Trilinear MIP mapping	■	■	■	■	■	■
Full-screen anti-aliasing	☐	☐	■	☐	☐	☐
Perspective texture correction	24-bit	8-bit, 16-bit	8-bit, 16-bit	24-bit	24-bit	8-bit, 16-bit
Anisotropic texture memory	☐	☐	☐	☐	☐	☐
Video texture mapping	■	☐	☐	■	■	■

N/A—Not applicable. The product does not have this feature.



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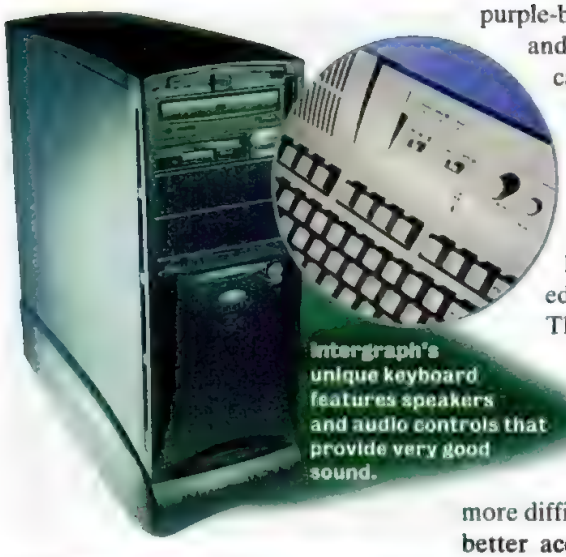

sible chassis. The machine's only salient drawback is the poor quality of its monitor. All of Intergraph's workstations—as well as its PCs and servers—are now based on Intel chips, but the company originally sold high-end workstations based on its own Clipper RISC processor.

The TDZ can't be mistaken for a common PC. It's enclosed in a contoured, purple-blue case, which is bulky, sturdy, and altogether imposing. Yet the case is also conducive to quick upgrades. After removing a top panel, you can—with some jostling—open a side panel and expose the system interior. The side panel can be locked shut to prevent unwanted entry.

The TDZ's four free bus slots and two available DIMM slots are relatively easy to access. Its available drive bays (two external, two internal) are a bit more difficult to reach, but you can gain better access to the external bays by using a screwdriver to remove the system's front panel. Like many Intergraph systems, the TDZ also connects to a keyboard with integrated speakers and audio controls, providing surprisingly good sound.

The system's performance was for the most part comparable with the roundup's other leading systems. Its application scores, often above average, included the top SolidWorks Geometric Mean and Graphics Mean scores. Its Winstone score was average, and its CPUmark score was the best in this roundup.

The TDZ also ships with Intergraph's InterSite system, which includes DMI querying, system monitoring, and software version management. Though Intergraph's Web-based support fails to match that of Dell or Gateway, it's a respectable complement to the company's three-year-parts, one-year-labor warranty. With such service amenities and helpful documentation, Intergraph—once exclusively a high-end workstation vendor—has fashioned a fine mainstream product.—*CM*

Silicon Graphics 540 Visual Workstation

Dual Pentium III Xeon/500, Silicon Graphics Cobalt graphics, 8.6GB Ultra-2 SCSI hard disk, 19.8" monitor. $9,761 direct. Mountain View, CA; 800-800-7441, 650-960-1980; www.sgi.com.

● Part of SGI's recent venture into the Intel-based market, the Silicon Graphics 540 Visual Workstation is by far the best

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ZIFF-DAVIS SOFTBANK

workstation in this roundup for video and audio production, editing, and special effects. Reflecting SGI's experience with RISC workstations, the system has a unique Advanced Visual Computing (AVC) architecture capable of video-editing functions that the other machines reviewed here can't perform. But users of other applications may want to look elsewhere, since the unit didn't perform as well on most CAD/CAM tests and can't accommodate many common upgrade components.

When used with in-sync corp.'s Speed Razor SE and other forthcoming packages, the Visual Workstation lets you input multiple streams of video, edit them with software-based video and hardware-based 3-D effects, and output them—all in real time. Audio and video I/O ports are individually and directly connected to the chip set—as are graphics, networking, and FireWire I/O. Thus, the machine can handle dual streams of uncompressed video without slowing or being slowed by the rest of the system. When SGI supplies drivers this summer, the IEEE 1394 (FireWire) ports will stream video in and out as well.

With other systems, you would need thousands of dollars in extra hardware to do such video editing. Even then, you couldn't do it in real time, except in very expensive editing systems, because *x*86 video cards continually compress and uncompress video during the process. The Visual Workstation delivered low scores on the SolidWorks and LightWave 3D tests. Results were better on our Softimage GL Render and 3D Studio Max Render tests, but well behind those of the leaders.

More than 26 inches high, the Visual Workstation's mostly gray chassis is cloaked by a blue side panel. When you press a rear button, this side panel pops off to expose a spacious interior and three open drive bays. SGI also provides six open bus slots, but these are 64-bit PCI slots and can't be used with most mainstream peripherals. Likewise, the system uses unique memory modules available only from SGI and a few other sources. On a positive note, the system does support up to four processors. SGI offers a three-year warranty and online support tools.—*CM* PC

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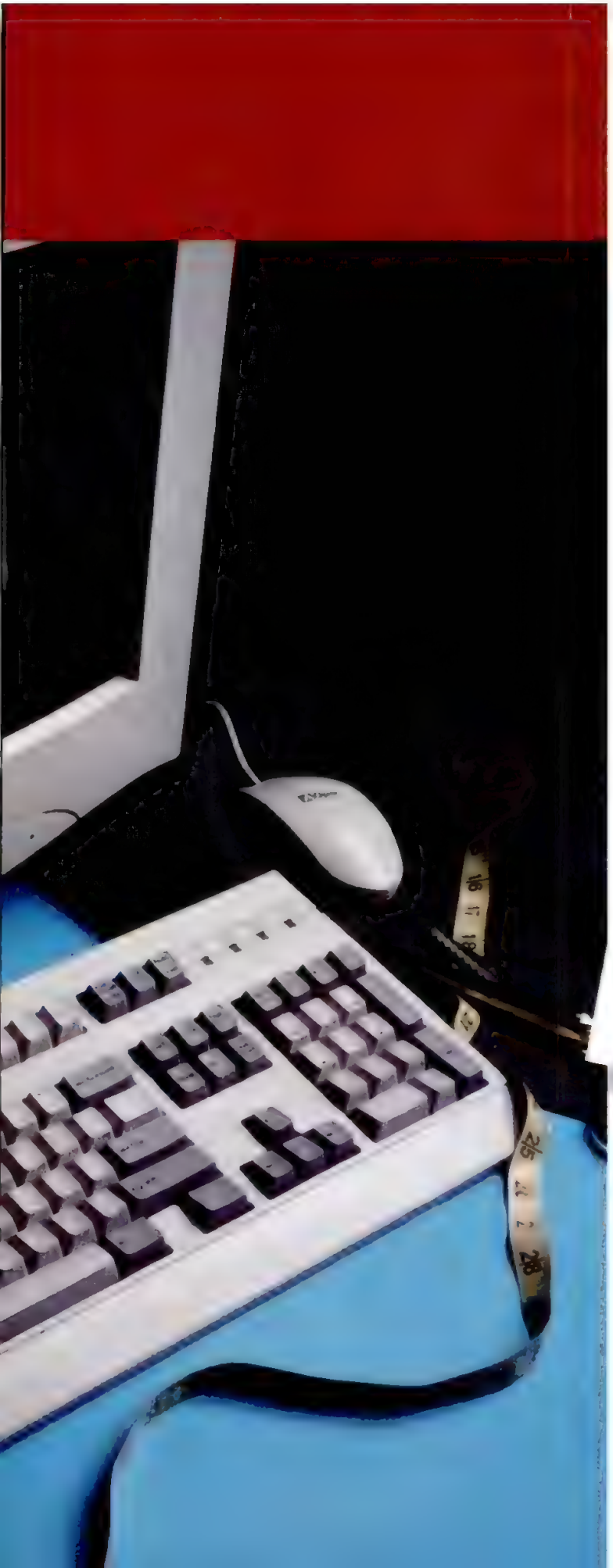

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monster
JobOptions
America's Job Bank

JOB HUNTING AND HIRING ON THE WEB

BY MICHAEL E. RYAN

Don't look now, but those red circles and scribbled notes most job seekers make when scouring the Sunday papers' help-wanted sections may soon be obsolete. Like so many other aspects of our lives, job hunting is rapidly finding a home on the Internet.

Just as you can readily research and purchase a car on the Web, you can also tap into vast online databases that are spilling over with job opportunities and candidates. Just a few years ago, such sites were solely the realm of computer and IT professionals, but you can now find online job listings for practically any type of job imaginable.

SPENDING GOES ONLINE

Though companies aren't dropping their newspaper ad budgets entirely in favor of the Internet, they are beginning to channel large chunks of money away from print and into online employment resources.

According to Forrester Research, employers who spent a total of $105 million on online advertising in 1998 are expected to bankroll a cool $2.7 billion for such ads by 2003. Why? Because online ads typically are less expensive, more dynamic, and easier to manage than their print counterparts. Furthermore, online ads tend to generate faster responses from applicants, which could help shorten the hiring cycle.

As more job seekers and employers rush headlong into the online employment arena, the ranks of employment Web sites have swelled to accommodate them. There are dozens of such sites available today, ranging from general employment resources to tightly focused sites dedicated to specific industries or groups.

For this story, we evaluated the eight of the most highly trafficked employment sites according to Media Metrix: America's Job Bank, CareerBuilder, CareerMosaic, CareerPath.com, HeadHunter.NET, HotJobs.com, JobOptions, and Monster.com. All eight let you search their databases for potential jobs and post ads to attract potential employees.

We examined each site from the viewpoints of both the job seeker and the employer. What we found was a wide range of features and costs associated with advertising and finding a job online. America's Job Bank and HeadHunter.NET can be used for absolutely no cost by job seekers and employers alike. The rest provide all job-seeker features free, but they charge a fee to employers for posting jobs and various other services.

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For job seekers, these sites all provide some form of search engine that lets users hunt down new jobs based on a variety of criteria, such as location and job title. The better sites also let users create and store a copy of their résumé online. Ideally, that résumé can then be used to apply for jobs the user finds on the site.

The best sites in the group provide a job search "agent," which automatically and repeatedly scans the site's database for jobs matching your search criteria, notifying you via e-mail as soon as a match is found. When testing these sites, we also looked for any useful information they provided for job seekers—career advice and résumé-building tips, for example.

Switching over to the employer's role, we evaluated each site's recruiter-specific features. How easy is it to post a new job on each site? And can you track statistics for the job once it's posted? Other important features include the ability to search a database of résumés and prescreening options that help employers eliminate résumés that clearly don't fit their profile.

WEED AND YE SHALL FIND

One of the biggest early criticisms of the online job search market is résumé overload. Because of the Internet's global nature, employers often receive résumés and applications from job seekers all over the planet—many of whom can't legally work in the U.S. in the first place. Prescreening options help weed out some of these responses early in the process.

Last, we considered the cost of using each site. Fees for employers tend to hover between $100 and $300 per online ad, which typically runs for at least 30 days. Some of the sites we reviewed allow employers to spend extra money to give their ads better visibility on the site.

Even $300 a month is a far cry from print-ad rates, which can reach over $1,000 for a single Sunday ad in *The New York Times*. That ad does reach an awful lot of people—and will even make its way online via CareerPath.com—but an ad on Monster.com can reach the

Our Contributors: MICHAEL E. RYAN is a frequent contributor to *PC Magazine*. BEN Z. GOTTESMAN is a technical director at *PC Magazine*. NANCY HIRSCH was the associate editor in charge of this story.

▶ ILLUSTRATIONS BY JEFF FOHL

same number of people, if not more.

So put down that red pen and get yourself plugged in to the online employment world. Whether you need a new job or a new employee, read on for the best online employment sites that will let you find either, with little more than a few mouse clicks and a keyword search.

▶▶America's Job Bank

www.jobsearch.org. Cost to recruiter: Free. Includes job posting, résumé database search. Vendor's estimated number of jobs: 900,000; maximum age: 1 month. Number of résumés: 310,000; maximum age: none.

IF YOU DIDN'T ALREADY know that America's Job Bank was run by a government agency, one look at the generic interface and unfriendly menus would tip you off to the fact that this is a joint effort of the Department of Labor and the Public Employment Service. Still, job seekers will find a lot to like on this free site, including a powerful search engine, job market information, and some decent résumé privacy features. America's Job Bank is also the only site we tested that doesn't charge recruiters for any of its services, but it still lacks the features to compete with the other sites here. In addition, general interface issues and occasional errors affect both job hunters and recruiters, placing America's Job Bank in the lower half of the pack.

Job Seekers ▶▶ America's Job Bank's powerful search engine is its most impressive aspect for job seekers. Users can search for job listings using keywords, location (both national and international), salary, ad age, education requirements, job type (full-time, part-time, contract), and experience requirements. Search results can then be sorted using up to four out of seven criteria (location, for example).

One of the site's other strong features is its abundance of statistical information on job markets. It can be a pain to access this data once you log on as a registered user (you have to backpedal to the home page to see the appropriate links), but the information is interesting and can be valuable.

America's Job Bank also offers job scouts, which are the equivalent of the agents offered by most other sites. Users can assign up to ten scouts to search for jobs automatically at specified intervals. The scout then e-mails the results to the user.

The site lets users maintain an online résumé and have excellent control over which information is viewable by employers. We were, however, unable to cut and paste a résumé into the online form. According to America's Job Bank, if your text has any special characters or formatting, you'll have the same problem.

Recruiters ◀◀ More problems arose when we looked at the site from an employer's perspective. The résumé search feature is as powerful as the job hunter's engine, but the interface is confusing, and we ran into several errors while trying to refine our searches.

Posting a job is easy enough, though the site doesn't let you monitor statistics for your job (how many hits it gets, for example). Also, America's Job Bank doesn't provide any way to prescreen job applicants, to promote your job postings, or to notify you when new candidates post résumés that might fit your current openings. The site offers a smattering of recruiting and hiring advice, but like the job seeker information, this material is difficult to access once you log on as a registered user.

As we went to press, America's Job Bank was about to undergo significant site design and content changes. We hope the new version of this site will be a little easier to navigate and offer more features for the employer.

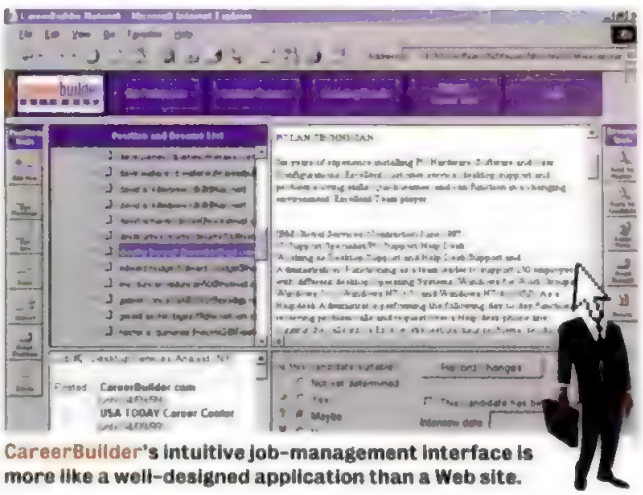
▶▶CareerBuilder

www.careerbuilder.com. Cost to recruiter: $150 per month per posting, per site within each network (volume discounts available). Vendor's estimated number of jobs: 70,000; maximum age: 1 month.

ONE OF THE MORE impressive sites in our roundup, CareerBuilder is an extremely powerful resource for job seekers and employers alike. Although it lacks the résumé resources the other sites provide, CareerBuilder offers a ton of features and a clean, intuitive interface.

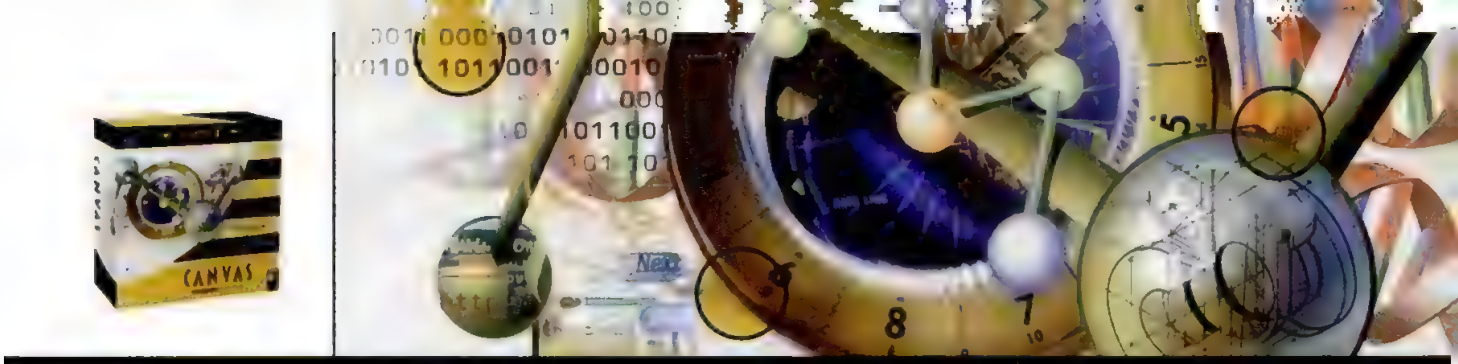
Job Seekers ▶▶ CareerBuilder's excellent job search engine lets users track down ads by location, job description, job type, salary, and keywords. You can also choose whether to include ads that provide no salary information at all. You can't, however, further refine your search results by adding new criteria.

Although CareerBuilder doesn't provide a customized home page for job seekers, it does let you set up as many as five job search agents per registered e-mail address. These agents will find job listings based on location, job type, job description, and salary and will e-mail you when a new match appears in the database. (There's even a handy map feature that shows you how to get to an *employer's office.)*



CareerBuilder's intuitive job-management interface is more like a well-designed application than a Web site.

You can't post a résumé on Career-



IT AIN'T BRAGGING IF IT'S TRUE.

(AT THIS RATE WE'RE GOING TO HAVE TO THINK OF SOMETHING ELSE TO CALL THEM BESIDES CRITICS.)

OF COURSE, WE'RE ONLY REPEATING WHAT THE EXPERTS ARE SAYING. CAN WE HELP IT IF THEY GO ON AND ON ABOUT OUR REVOLUTIONARY SPRITELAYER™ TECHNOLOGY AND ITS NEAR MAGICAL ABILITY WITH TRANSPARENCIES? IS IT OUR FAULT THEY'RE SMITTEN WITH CANVAS 6'S KNACK FOR CUT-AWAYS, VIGNETTES AND COLLAGES? WE'RE STILL BLUSHING OVER THE RAVES FOR ITS SNAZZY CUSTOMIZABLE INTERFACE, IMAGE EDITING AND EASE OF USE. GRANTED, WE COULD HAVE KEPT ALL THIS TO OURSELVES. BUT THEN HUMILITY CAN BE HIGHLY OVERRATED.

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"Comparing [Freehand, Illustrator and CorelDraw] directly to Canvas is like comparing apples to, well, the whole basket of fruit...In the competition of the graphics titans, Canvas 6 is fighting with a unique set of weapons." **Macworld. February, 1999** "SpriteLayer technology is an excellent piece of programming wizardry. With it, designers can easily experiment with complex graphic ideas that would have been prohibitive or impossible in any other program." **Digital Design and Production. January/February, 1999** "With its elegant interface, Canvas is a compelling alternative to suite-based solutions that require separate illustration and image editing programs to perform the same functions." **PC Magazine. January, 1999** "...A standalone graphics application that skillfully integrates its separate components. Canvas 6's price and its range of tools combine to earn it a place on our WinList." **Windows. March, 1999** "...An integrated, easy-to-use graphics package that's so sophisticated you're not likely to outgrow it... We found Canvas 6's transparency tools alone to be worth the upgrade price." **PC Computing. March, 1999** "The hype is well deserved...Canvas 6 features a variety of transparencies that can significantly bump up the oh-la-la quotient of your images." **MacAddict. April, 1999** "Deneba has done what Adobe has refused to do: unify graphics apps...Canvas 6.0's unique ability to combine disciplines will lead the designer down previously inaccessible creative paths...SpriteLayers composite like no other program can." **Maximum PC. January, 1999** "Canvas 6's array of new transparency tools allows you to create awesome depth and layering in your images – and it does so better than other graphics products on the market today." **MacAddict Magazine.** "Canvas continues to deliver a vast scope of graphics tools in one convenient application, and does a remarkable job of breaking down barriers between bitmap and vector graphics." **PC World Online. December 28, 1998** "...No program comes close to Canvas's ability to combine vector and bitmapped graphics...Canvas 6's strong integration of text, painting and drawing tools makes it a good one-stop graphics application." **Macworld. March, 1999**

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Builder, but you can apply for jobs online either via e-mail (attaching your résumé in whatever format you wish) or through forms on the site, which let you cut and paste résumé data. The site also provides a wealth of information and advice for job seekers, covering such topics as building a better résumé and even offering some business "intelligence" on employers (financial information, for example).

Recruiters ◀◀ There's even more for employers to like on CareerBuilder, which shines as a recruiting tool. Registered employers access the site through a unique URL that provides a database-style interface to current job postings and applicants. But because job seekers can't post their résumés, there's no option to let employers search for them.

When you post a job description on CareerBuilder, an intuitive wizard walks you through the entire process. To activate the ad, you order its placement on up to 20 sites in the CareerBuilder network. These include CareerBuilder's own job database, the USA Today Career Center and the CNET Online Career Center. Each site you add to your job-posting order costs extra, so be careful which ones you choose. When we selected all the tech-related sites, for example, our order quickly rose to over $2,000 for a 30-day ad. Still, CareerBuilder generates a lot of traffic, and we received a tremendous number of responses to our ads.

You won't find automatic filters for responses to your ads on CareerBuilder, but the slick applet interface lets you filter incoming résumés manually, adding notations where appropriate and then routing the applications to other folks involved in the hiring process. Using CareerBuilder felt more like using a custom database than a Web site (apart from the slow load times, that is).

We also liked being able to upgrade job postings' visibility through a series of online ad banners and "hot company" profile spots on the CareerBuilder site. With support for saved résumés and the ability to let employers search for them, CareerBuilder would present a serious challenge to Monster.com's status as the best all-around online employment site. Even without the résumé features, however, CareerBuilder is a great choice for both job seekers and employers.

editors' CHOICE

• Monster.com

PC MAGAZINE EDITORS' CHOICE

Each of the sites in this roundup brings something to the table, but none can beat Monster.com's impressive combination of ease of use and power for both job seekers and employers. For job seekers, the excellent search engine and support for multiple job-search agents and cover letters make Monster.com a versatile and highly customizable resource. Recruiters, in turn, will appreciate the search engine, along with the experience-screening option and the site's unique ability to notify you of new job candidates automatically.

JobOptions impressed us enough to warrant honorable mention, by offering the best interface in the group and by providing a feature set that came close to Monster.com's in many respects. HotJobs.com also deserves mention for its slick design, intuitive features, and innovative true/false applicant-screening test.

▶▶CareerMosaic

www.careermosaic.com. Cost to recruiter: $160 per posting per month, $600 for access to the résumé database for 6 months. Vendor's estimated number of jobs: over 100,000; maximum age: 1 month. Number of résumés: over 100,000; maximum age: 4 months.

ONE OF THE OLDEST and most recognizable names in this roundup, CareerMosaic is beginning to show its age. Though it offers a decent set of features for job seekers and a basic array of options for employers, CareerMosaic doesn't quite have a broad enough feature set to compete with Monster.com or JobOptions.

The CareerMosaic interface is serviceable, with a large image map at the top of the home page serving as the primary guidepost for the site. Unfortunately, the image map draws attention away from a host of links at the bottom of the page, most of which lead to helpful information and advice for job seekers.

Job Seekers ▶▶ Tools on CareerMosaic for the job seeker include a search engine that lets you look for jobs based on job description, job title, company name, country, city, state, and ZIP code. But search results are presented in a plain, bunched-up list of single-spaced items. Better formatting would make it easier to skim the results. CareerMosaic doesn't offer a refine-search feature, either, as some of the other sites do.

You can set up job search agents that run at user-defined intervals for as long as 120 days, looking for new job postings and notifying you via e-mail when a listing fits your search criteria. Once you set up an agent, however, CareerMosaic doesn't let you manage it online; you can only cancel it via e-mail and create a new one.

CareerMosaic lets you enter and save a résumé on the site, but you can't use this online résumé to apply for a job listed on the CareerMosaic site. Your online résumé is useful only for those employers that conduct a résumé search. So if you apply for a job online, you still must type or cut and paste your résumé into a form to submit it.

Recruiters ◀◀ The picture doesn't get any rosier on the recruitment side of CareerMosaic. The search engine is capable enough, allowing you to conduct a résumé search using keywords, location, résumé age, country, and job category (access to the résumé database costs $600 for six months). The site doesn't provide any résumé prescreening options, however.

To post a job, you fill in the blanks on a form, but there aren't many options for indexing your posting. You can't pick an industry type for your ad from a pull-down menu, for example, which would ensure your listing would be returned if someone queried jobs in that category.

On the whole, CareerMosaic needs a major overhaul. It's still a good site for job seekers because plenty of employers continue to post jobs there. Likewise, employers continue to use CareerMosaic because it gets a lot of job-seeker traffic. But it falls short in terms of features and usability.

There has to be a synergy between a site's appeal to job seekers and to recruiters. Job seekers won't stay at a site that offers few potential jobs, and employers are unlikely to post openings on a site that provides few qualified candidates.

Job seekers: We started by examining each site's search engine to test how easily you can find relevant job postings. We also looked at how the site notifies you about new opportunities. We then applied for jobs using the site's tools to create an online résumé, submitted the résumé, and tracked the status of applications. At the same time, we tested the privacy features that ensure that the wrong people (including your current employer) don't come across your résumé. Finally, we looked at the articles, discussion groups, and other tools the site provides to help you get ahead in your current job or find a new one.

Recruiters: We began our evaluation by searching the site's database for qualified candidates. We then posted actual open positions at Ziff-Davis, our parent company, on each site. We looked at how the site let us make our job postings more visible and filter out inappropriate applications. We also looked at the articles and forums available to help you hire most effectively. As with all our Web site evaluations, we also carefully examined each site's layout, design, and support offerings.—*Ben Z. Gottesman*

	America's Job Bank	CareerBuilder	CareerMosaic	CareerPath.com	HeadHunter .NET	HotJobs.com	JobOptions	EDITORS' CHOICE Monster.com
GENERAL								
Interface and navigation	Fair	Good	Fair	Good	Good	Good	Excellent	Excellent
Personalization	Fair	Fair	Poor	Fair	Good	Excellent	Good	Excellent
Online help and support	Fair	Excellent	Fair	Fair	Good	Good	Good	Excellent
JOB SEEKER								
Search engine	Good	Excellent	Fair	Fair	Fair	Good	Good	Good
Notification of new jobs	Good	Excellent	Good	N/A[1]	N/A[1]	Good	Excellent	Good
Applying for a job	Fair	Good	Fair	Poor	Good	Good	Excellent	Excellent
Résumé services	Fair	N/A[2]	Fair	Fair	Fair	Good	Excellent	Excellent
Privacy	Good	N/A[2]	Poor	Excellent	Good	Excellent	Fair	N/A[1]
Career advice	Good	Excellent	Fair	Good	N/A[1]	Fair	Good	Excellent
RECRUITER								
Search engine	Fair	N/A[2]	Fair	Fair	Fair	Fair	Fair	Good
Job posting	Fair	Excellent	Fair	Poor	Good	Good	Excellent	Excellent
Job visibility	N/A[1]	Good	Fair	Fair	Excellent	Good	Excellent	Good
Prescreening	N/A[1]	Good	N/A[1]	N/A[1]	N/A[1]	Excellent	N/A[1]	Excellent
Recruiting and hiring advice	Poor	Good	Poor	Poor	N/A[1]	Fair	Good	Excellent

N/A[1]—Not applicable: The site does not include this feature. N/A[2]—Not applicable: CareerBuilder has no résumé database.

▶▶CareerPath.com

www.careerpath.com. Cost to recruiter: Free when you place an ad in any of 85 newspapers, or $3,500 per month for up to 250 jobs scanned from your Web site. Vendor's estimated number of jobs: 300,000; maximum age: 2 weeks. Number of résumés: 450,000; maximum age: 1 year.

CAREERPATH.COM PROVIDES EASY online access to help-wanted ads from 85 major newspapers, including *The New York Times*. The intuitive search engine makes CareerPath.com a great choice for job seekers, but the weak employer/recruiter features limit the site's appeal to that sector.

CareerPath.com is a nicely designed site, with large colorful buttons to guide you through the first few pages. For the most part, the subsequent pages are equally intuitive. The site offers no real personalization features, however, and the online help and support are limited.

Job Seekers ▶▶ When looking for a job on CareerPath.com, you must first decide whether to search newspaper ads or ads culled from employers' Web sites. However, there's no reason to confront the user with this choice; the difference between the two should be invisible to the user, and the search options (which are presented differently for each) should be the same.

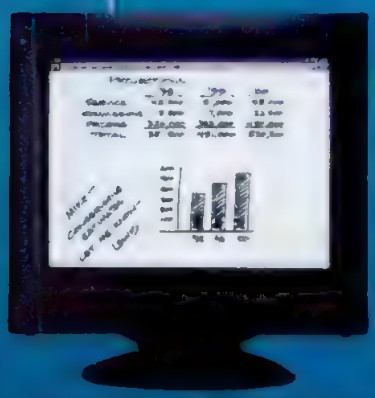
You can perform newspaper searches on CareerPath.com using keywords, job categories, and ad age (no ads on the site are more than two weeks old). The search then runs on your choice of up to ten newspapers. Web searches are different, though: You can search by employer name, location, industry, job category, and keywords.

CareerPath.com doesn't offer any automated job search agents. It does, however, provide an excellent range of privacy options for online résumés: You can block your résumé completely, block just the contact information, or leave it all open for public viewing. To build a résumé on CareerPath.com, you can cut and paste your career information, which is then scanned by a text parser that attempts to build a summary for skimming by employers. A neat idea, but the parser introduces so many errors that it would be easier to key in the summary manually.

Recruiters ◀◀ On the recruiter side of the site, CareerPath.com doesn't compare favorably with most of its competition. For starters, we couldn't post a job online ourselves. That feature was in beta testing, but it should be up and running by the time you read this. In the meantime, you must either take out a print ad in one of the 85 newspapers whose ads CareerPath.com searches, or place an ad on your Web site so it can be scanned for inclusion on CareerPath.com.

You can search for résumés using résumé age, skills, experience, education, and location as basic criteria. An advanced search lets you add further variables. You can also save up to 30 sets of

upload



It's already gotten rave reviews in Wired, Business Week, and PC Computing.

WHAT WILL THEY SAY NOW THAT WE'VE LOWERED THE PRICE?!

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- [redacted]
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Resumail
www.jobs.com
E-mail gateways can garble your résumé. To make sure it looks as good on a recruiter's desk as it did on your desktop, get this free download from *www.jobs.com* or ZDNet's Software Library at *www.hotfiles.com*.

The Riley Guide
www.rileyguide.com
Amazingly comprehensive, The Riley Guide's collection of links covers just about every resource to help job seekers, including a huge selection of links to job listings.

Wanted Jobs
www.wantedjobs.com
Fill out your career criteria and this free software will search all the most popular career sites and deliver job listings to your desktop.

Careers.wsj.com
http://careers.wsj.com
The site for content from Dow Jones & Co. publications including *The Wall Street Journal* and for job postings with a decidedly upper-management slant.

6figurejobs.com
http://6figurejobs.com
For free access to listings of jobs paying $100,000 and over in IT, business, and finance, this is the site.

search criteria, which is helpful if you frequently need to look for candidates with similar qualifications.

CareerPath.com offers no automatic résumé-filtering features, and no new-candidate notification feature. And although CareerPath.com has an abundance of job-hunting advice, there's very little information for employers on the site. So for now, CareerPath.com is a convenient online front end for skimming most of the nation's newspaper ads.

▶▶HeadHunter.NET

www.headhunter.net. Cost to recruiter: Basic listing, free; upgrades starting at $25; $700 for access to the résumé database for 3 months. Vendor's estimated number of jobs: 240,000; maximum age: 45 days. Number of résumés: 133,000; maximum age: 3 months.

UNLIKE MOST OF THE sites in this story, HeadHunter.NET can be used by both job seekers and employers at absolutely no charge. Alternatively, users can pay to upgrade their résumés or job postings for better visibility. The site doesn't provide a lot of extra features for employers, however, and that puts it at a disadvantage.

The site's interface is clean and relatively simple. Users can set up a personalized home page called "My Stuff," which provides easy access to both job searches and employer-oriented résumé searches. Lumping the two options together is unnecessary and potentially confusing; users are either looking for a job or looking for an employee, but rarely both.

Job Seekers ▶▶ HeadHunter.NET offers job seekers a decent search engine that uses keywords, job category, education, salary, and job type as criteria. Job listings that have been upgraded for a fee appear at the top of the results list after a search. The list indicates which ads have been upgraded, and a tool tip window pops up to show how much they cost.

Applying for a job on HeadHunter.NET is easy. You have the option to reply to an ad via e-mail or through the site using a submission form and an online résumé. You can also add a cover letter, though you can't preview your complete submission. HeadHunter.NET's résumé features cover the basics: You can cut and paste or type in your information, but there's no preview feature or way to track statistics. Just as employers can upgrade their ads, you can pay $10 to $100 for 30 days so that your résumé bubbles up the list when recruiters search for job candidates.

Recruiters ◀◀ The site's big attractions for employers are free basic ads and a great array of job-promotion options. It's relatively easy to post a job on HeadHunter.NET, and just as easy to upgrade it (the first upgrade is $25, and there's no limit on how much you can spend). When posting an ad, you can select up to five general categories under which the ad will be indexed.

The résumé search engine is virtually identical to the one used by job seekers (access to the HeadHunter.NET résumé database is $700 for three months). Again, the search results indicate which résumés have been upgraded and for how much money.

The site doesn't provide any résumé-filtering features, nor does it alert you in any way when new candidates matching your job requirements appear on the system. Finally, apart from the ever-present sales pitches promoting job-posting upgrades and basic guidance for navigating around the site, you won't find any advice for employers on HeadHunter.NET.

HeadHunter.NET is a great place for job seekers to dig around and for employers to post a free or low-cost ad to widen the cast of their nets. But the lack of serious employer tools limit its appeal.

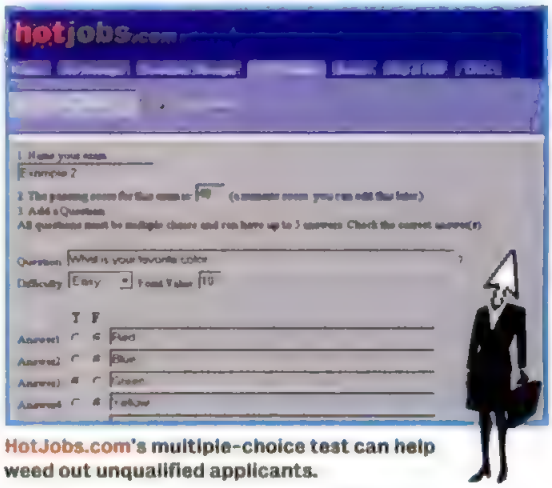
▶▶HotJobs.com

www.hotjobs.com. Cost to recruiter: $800 per user per month. Includes 20 job postings; price per user decreases for multiple users. Vendor's estimated number of jobs: 22,000; maximum age: none. Number of résumés: 260,000; maximum age: none.

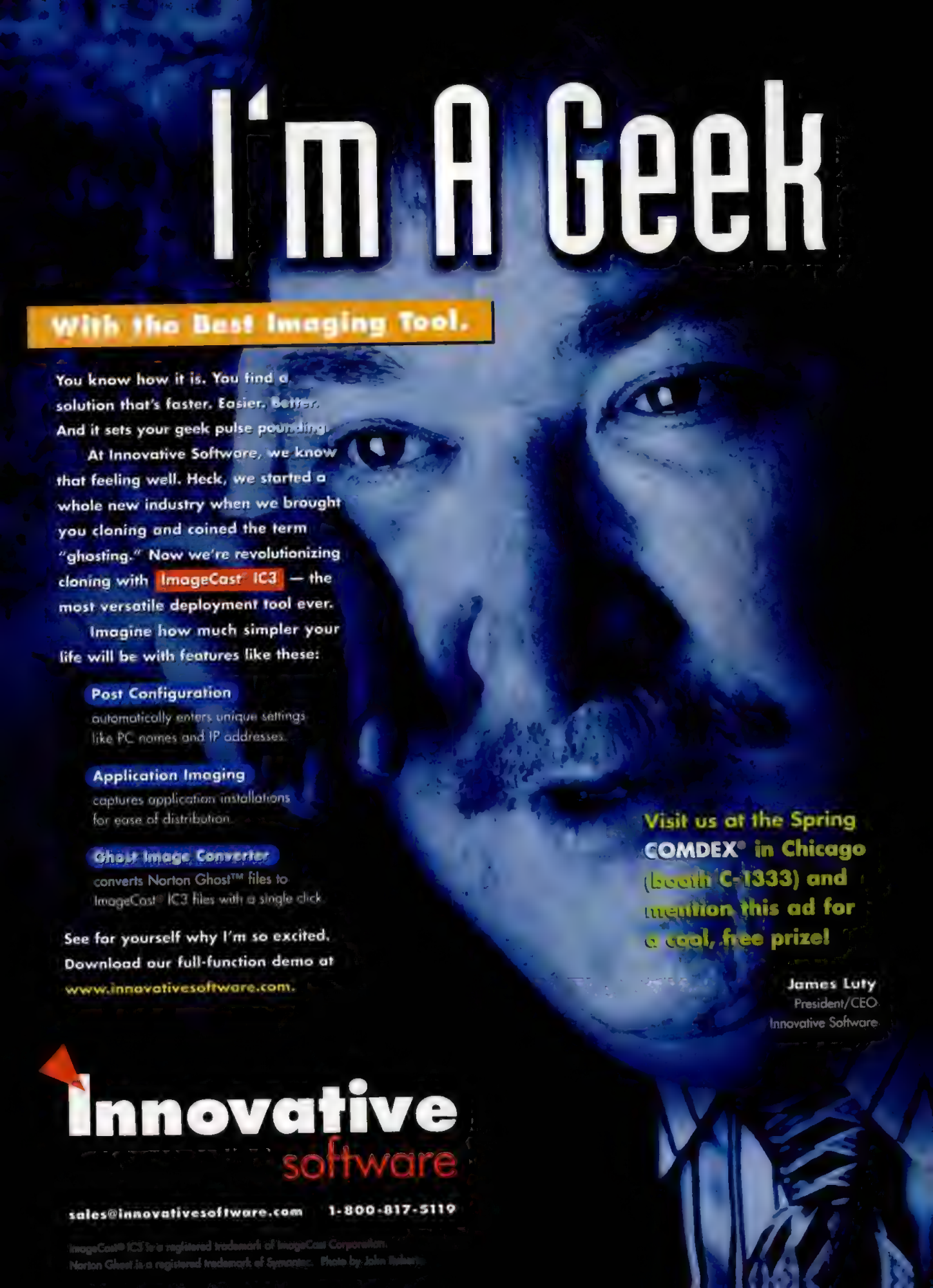
HOTJOBS.COM IS ONE of the best all-around job search sites we reviewed. Offering some truly unique features, such as a multiple-choice quiz for job applicants, HotJobs.com slips just slightly behind front-runner Monster.com because of a few subtle drawbacks.

Job Seekers ▶▶ On the job-seeker front, HotJobs.com provides a wealth of features. The job search engine is strong, with criteria ranging from general keywords and job type to niche regions, which can help you track down a position in hot spots around the country, such as the New York City metropolitan area and Research Triangle Park, North Carolina. Search results are well organized and easy to view.

HotJobs.com lets you set up a single job search agent, which will run for one month and inform you of new openings that might be of interest. This is an area



HotJobs.com's multiple-choice test can help weed out unqualified applicants.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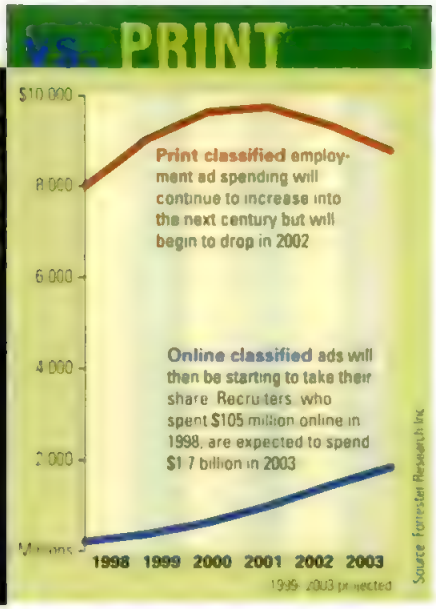


where HotJobs.com is good but not quite up to the level of Monster.com. For example, where HotJobs.com supports one agent, Monster.com supports five.

Still, HotJobs.com makes it easy to apply for jobs online. Whether you've registered or not, you can quickly and easily fire off a résumé to any ad you find on the site. You can build an online résumé, and the excellent privacy features let you limit access to it. You can, for example, block access by a specific HotJobs.com member company (useful if that company happens to be your current employer).

HotJobs.com also offers a job seeker lounge area, where you can post messages and chat with fellow job hunters. The site also tracks how often your résumé is viewed and even how often it appears in a list of search results.

Recruiters ◀◀ HotJobs.com offers one truly innovative feature for employers: the ability to create a multiple-choice quiz that all users must complete before submitting an application for your job posting.

You type in the questions, enter the correct responses, provide a minimum total score, and let HotJobs.com do the rest. Any applicant who doesn't meet the minimum score will be automatically filtered out of your applicant pool. We also like that HotJobs.com lets you screen out all applicants who can't work legally in the United States.

Job posting, however, is tedious, because you have to use HTML tags to format your ads effectively—a chore that should be taken care of automatically. Also, the site doesn't provide new-candidate notification, and there really isn't much available in the way of hiring advice. There are, however, a chat area and message board for both recruiters and job seekers.

HotJobs.com looks to be a serious, up-and-coming challenger for Monster.com and JobOptions. It doesn't quite have the guns to topple either right now, but by the time we look at this category again, HotJobs.com could easily be the frontrunner in this market.

▶▶JobOptions

www.joboptions.com. Cost to recruiter: $395 per month. Includes 10 job postings for 60 days, access to the résumé database for 3 users. Vendor's estimated number of jobs: 50,000; maximum age: 2 months. Number of résumés: 130,000; maximum age: 1 year.

IF YOU'RE LOOKING FOR an intuitive, powerful, and feature-rich job search site, JobOptions is for you. Apart from a lack of privacy features and prescreening tools, JobOptions has what it takes to sit right near Monster.com at the head of this class. JobOptions' interface—the best of the group of sites we tested—uses tabs and 3-D–style buttons to provide easy access to a wealth of features for both job seekers and employers.

Job Seekers ▶▶ JobOptions' search engine lets you hunt for openings in up to five states and five job categories, using keywords to narrow the search. There's no refine-search option, but the site does let you set up as many as three automated job search agents.

JobOptions also lets you save up to three different résumés. Using the résumé-building features, you can either type in a custom HTML-formatted résumé or simply cut and paste existing résumé data to create an ASCII text version. Once your résumé is complete, several options let you indicate where you want it indexed on the site. You can also preview it before saving it to the database.

We were especially impressed with the features JobOptions provides for applying to an online ad. You can either use your saved online résumé or send a note via e-mail. If you send your online résumé you can also attach a brief cover letter. The original ad text conveniently appears on the application screen, so you can refer to the job description and contact information while writing your cover letter.

Résumé privacy options let you control who gets to see your résumé, but rival HotJobs.com provides more options in this area. You can, however, choose to be listed as either an active or passive job seeker on JobOptions. You'll also find links to a ton of job-hunting information and career advice throughout the site.

Recruiters ◀◀ JobOptions provides excellent job-posting features. Though not quite as intuitive as CareerBuilder's wizard, the JobOptions posting interface provides a slew of options and is easy to navigate. Also, your personalized start page lets you edit each job posting after it goes online and track how many times each has been viewed.

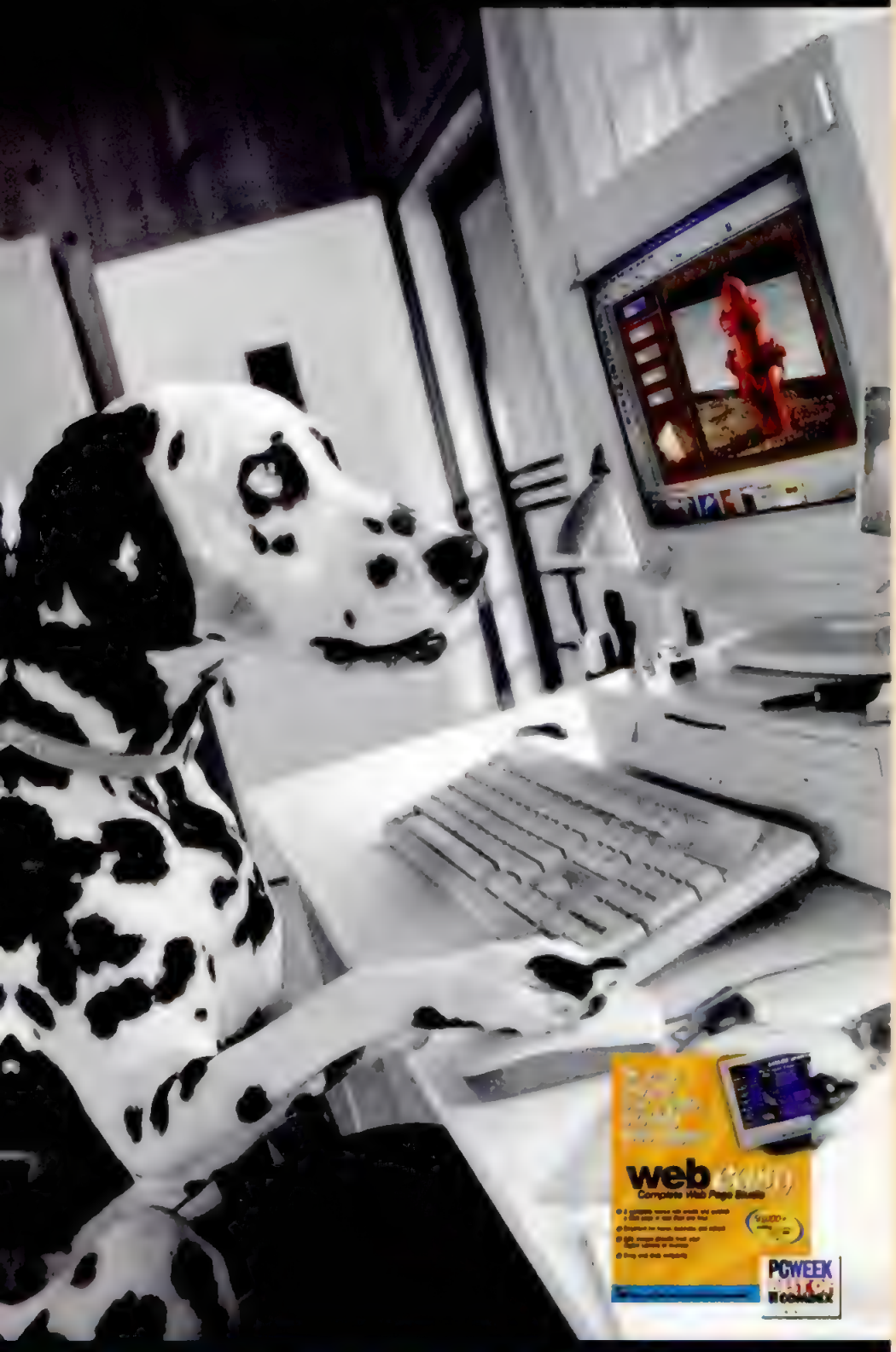
Employers looking for extra visibility for their ads can take advantage of JobOptions' excellent job-promotion features. For an additional fee, you can buy ad banners that appear on various parts of the site. These ads rotate and are easy to spot, but they're small enough that they don't get in the way or annoy.

JobOptions offers a fair amount of hiring advice via external links, but these links would be more effective if they opened up in a new browser window. That way, you wouldn't have to leave the site for a little guidance on hiring and firing.

On the whole, JobOptions is impressive. Its feature set is rich enough to compete with Monster.com, and its well designed, intuitive interface makes the site particularly easy to use.

JobOptions' TurboTax–style interface, was the best and easiest to navigate.

It's time for you to make your mark on the World Wide Web.



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Besides the job-search sites we reviewed, we also looked at a pair of online recruiting agencies: Career Central and I-Search.

These two sites are not just job-posting databases. They provide a variety of customized services to identify the most appropriate candidates for a given job. Here the quality, not quantity of applicants is the rule. This sort of job-filling help doesn't come cheap—at least not for employers (job-seeker services are free).

Career Central's services are balanced between job seeker and employer. Career Central works with recruits to develop effective search criteria for a given job opening. The company then takes that information and matches it against its database of job seekers, e-mailing the job information to the best candidates. Those interested then respond via e-mail with their résumés, and Career Central puts them in touch with the employer.

Career Central handles all the middleman work to line up employer with employee. Turnaround time for the entire process is about five days, which can be a big help in shortening the typical hiring process. ($3,495 per candidate search; special pricing for new or high-volume customers; free for job seekers. Career Central Corp., *www.careercentral.com*.)

I-Search offers different levels of service to help companies better manage their online job-posting presence and coordinate their pool of applicants. Private Reserve, I-Search's résumé database service, organizes all résumés submitted to a company—by e-mail, fax, or regular mail—into a single database that can be searched from any desktop.

Private Postings, I-Search's job-posting service, lets a client post and track job openings on the I-Search servers while maintaining the look and feel of the client's corporate Web site. This service directs all incoming résumés to the client, or if the client is also a Private Reserve customer, incorporates them directly into the Private Reserve database. Finally, I-Search offers powerful tracking and reporting features that let clients monitor all aspects of the staffing process.

I-Search also provides services for the job seeker, mostly through the creation of job search databases in conjunction with strategic partners. Ziff-Davis (*PC Magazine*'s parent company) has teamed with I-Search, for example, to provide JobEngine (*www.jobengine.com*), a site specializing in the computer industry and IT-related positions. ($3,000 to $400,000 a year; free for job seekers. Interactive Search, *www.isearch.com*.)

Monster.com

www.monster.com. Cost to recruiter: $7,900. Includes 30 job postings for 60 days, access to the résumé database for 1 user/1 year, company profile on the site, and 5 skill screens per job (other packages available). Vendor's estimated number of jobs: 180,000; maximum age: 2 months. Number of résumés: 1,000,000; maximum age: 1 year.

PC MAGAZINE EDITORS' CHOICE

EASILY THE MOST recognizable name in online job sites, Monster.com is also the best one for both job seekers and employers. Although it's the most expensive site we reviewed, Monster.com offers the best mix of features, power, maturity, and ease of use. This is the site against which all the others must be measured, which is why it is our Editors' Choice.

The interface is elegant, and general navigation is a breeze. In most areas, context-sensitive help opens in a separate window, so you don't lose your place on the site, and you can still see your main browser window.

Job Seekers ▶▶ Monster.com is highly customizable via the My Monster option. Here you can set up and manage job-search agents (up to five), résumés, and cover letters, as well as track your job applications. From My Monster you can also access chat rooms and message boards. You can search for jobs by location, profession, industry, and keyword. A few more filtering options would be helpful (salary, for example), but the excellent refine-search feature compensates for that minor shortcoming.

Monster.com's job search agents report their progress daily (there's no way to modify the search interval). Once you find a job you like, you can apply online using your saved online résumé or by sending an e-mail. You can also attach one of up to five saved cover letters. Your My Monster page will keep track of all the jobs for which you apply.

The résumé-building services on Monster.com are the best of the bunch. You have plenty of control over how the résumé looks, and it's easy to edit. And once you post the résumé, you can track how often it is viewed.

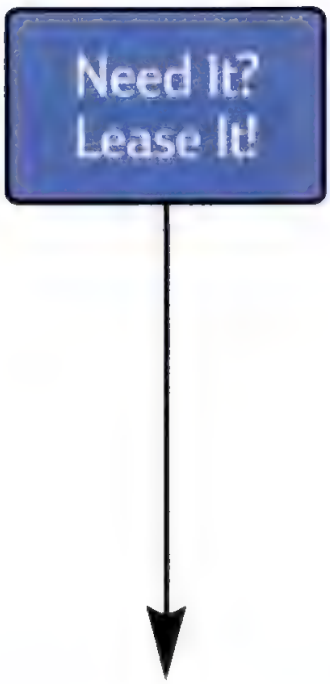
Recruiters ◀◀ With Monster.com's admirable résumé search engine, you can hunt for candidates by criteria including résumé age, location, education, job type, and keywords. You can also refine your search to trim down the results, which are displayed in an informative, easy-to-read manner.

Job descriptions are simple to post and edit, with lots of options for categorizing them in the database. After posting them in the database, you can see how often each ad is viewed and how many applications it generates.

Monster.com prescreens résumés by letting you select up to five job-specific skill screens for each ad. You assign each skill a minimum experience level score, and job seekers have to enter information stating how much experience they have in each area. If they don't meet your minimum requirements, they're removed from your applicant pool. Monster.com is also the only site we tested that will notify you when a new candidate's skills or experience match one of your job openings.

Lots of features and incredible ease of use are the general rule on Monster.com. Though it faces serious competition, Monster.com is definitely the most well-rounded, feature-rich site in this group. PC

In many areas of Monster.com, context-sensitive help appears in a new browser window.



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*Quoted lease payments based on average base unit reseller price as of February 1999 and a 36-month business lease with no down payment required. Lease payments apply to single units with minimum transaction size of $1,500. Not all products will meet minimum transaction size on single units. Terms contingent upon credit approval and product availability. Rates and promotion are subject to change without notice. Taxes not included. Units above are: HP LaserJet 5000GN, HP LaserJet 8100N, HP Color LaserJet 4500DN, HP Color LaserJet 8500DN.

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Expanding Possibilities

COLOR NET

From lasers to the new fast ink jets, color printers are now affordable and robust enough to serve as your only network printers.

By James Karney

Color on the network has finally come of age. Previous generations of networkable color printers—namely color lasers—always fell short in one critical area, be it speed, manageability, output quality, paper handling, or price. But this year has brought a host of models that remedy the shortcomings, so you can finally put a color printer on your network with no hassles, no excuses, and most important, no monochrome laser to pick up the slack.

Colorful presentations and Web pages, plus greater use of business graphics and digital photography, have primed the market for color. And indeed, color printers have been slowly infiltrating the business world, mostly in the guise of inexpensive personal ink jets on the desks of a few. But scattered printers are a management nightmare and hardly a cost-effective way to deploy resources. To meet this emerging demand, vendors are offering network-ready products with the speed and paper-handling options usually found on monochrome workhorse printers, and at much more attractive prices than in the past: The cost of entry for a color laser has dropped to as low as $2,000 this year, down from $3,000 last year and $5,000 the year before that. This means you can commit to a color laser as the *only* printer your users share, rather than reserving color for a select few.

For this roundup we tested 15 color printers intended for business use in a shared environment. To keep up with the rigors of network use, the printers had to have a rated speed of at least 8 pages per minute (ppm) for monochrome pages and 4 ppm for color. We also required the package to include a management utility compatible with NetWare and Windows NT network operating systems.

HP's Color LaserJet 4500DN (below) and 8500N are the best all-around printers we found.

Consider ink jet. The ink jets in this class (such as the $1,000 **HP 2500Cxi***) deliver stunning output on glossy stock, though at a slower pace than the laser competition.*

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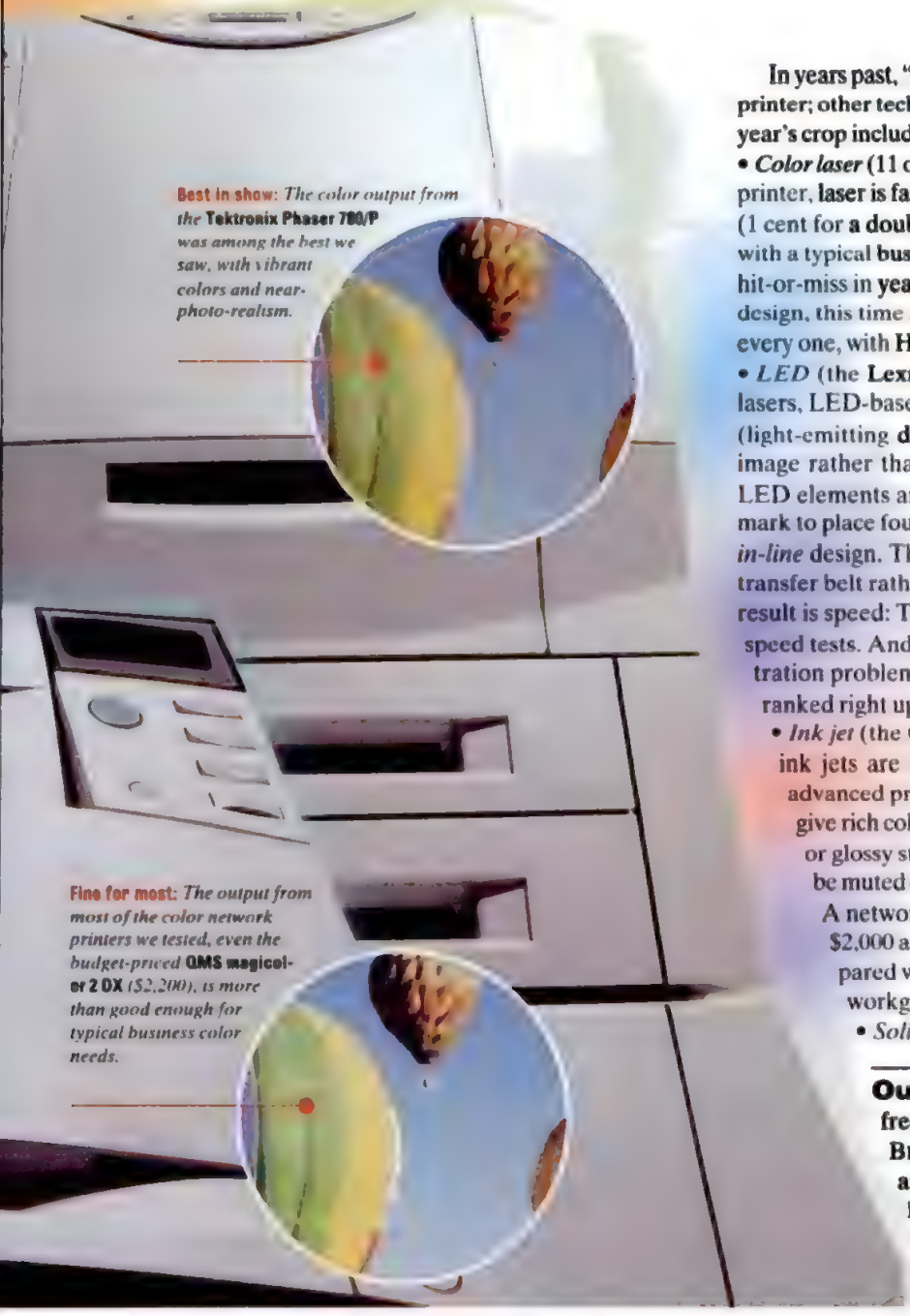
WORK PRINTERS



Best in show: *The color output from the* **Tektronix Phaser 780/P** *was among the best we saw, with vibrant colors and near-photo-realism.*

Fine for most: *The output from most of the color network printers we tested, even the budget-priced* **QMS magicolor 2 DX** *($2,200), is more than good enough for typical business color needs.*

In years past, "network color" generally implied a laser-based printer; other technologies simply were not fast enough. But this year's crop includes four distinct printing technologies:

- *Color laser* (11 of the units). Still the standard for a shared color printer, laser is fast, and per-page costs are generally reasonable (1 cent for a double-spaced text page, 10 cents for a color page with a typical business graph or chart). Output quality has been hit-or-miss in years past, but thanks to improvements in engine design, this time around we saw good to excellent output from every one, with HP and Tektronix leading the pack.
- *LED* (the Lexmark Optra Color 1200n). A close cousin to lasers, LED-based printers use a row of closely packed LEDs (light-emitting diodes) to charge the transfer drum with the image rather than using a laser and lens-and-mirror system. LED elements are less costly than lasers, which enabled Lexmark to place four LED printheads (one for each color) into an *in-line* design. This way, the paper makes a single pass over a transfer belt rather than making four trips around a drum. The result is speed: The Optra was the fastest overall on our color speed tests. And Lexmark has apparently overcome the registration problems we saw in earlier in-line designs; its output ranked right up there with the true lasers.
- *Ink jet* (the Canon BJC-6000 and, HP 2500Cxi). Network ink jets are much more robust than home models, with advanced printheads and paper-handling systems. Ink jets give rich colors and photo-quality output on transparencies or glossy stock, though on plain bond some tones tend to be muted or even dull. But the real draw of ink jets is cost: A networkable ink jet costs from $400 to $1,000, versus $2,000 and up for a laser. Alas, their slower speed compared with lasers means that ink jets are best for small workgroups of not more than ten users.
- *Solid ink* (the Tektronix Phaser 840/DP). This

Our Contributors JAMES KARNEY is a frequent contributor to *PC Magazine*. BRUCE BROWN, ALFRED POOR, and M. DAVID STONE are contributing editors to the magazine, and DAVID A. HARVEY is a freelance writer. S. JAE YANG was the project leader, and JAMIE M. BSALES was the editor in charge of this story.

model fuses melted ink directly to the paper. Output quality is excellent, with deep, saturated colors. Solid-ink printers have generally had a rap as being slow, but Tektronix has improved the technology to where the 840/DP can keep pace with some of the slower color lasers, though it falls behind the others on black-only jobs.

Knowing the type of output your users want is important in evaluating print quality as well. If it's just some color to liven up the page and brighten up Microsoft PowerPoint presentations, then any of the units we tested should be able to handle the job. The ink jets will usually do a better job with photographic images, but with a significant performance hit and at a higher cost per page.

Given the lower number of color network printers sold, not all vendors are offering the full line of options found on their monochrome models. If you want tabloid-size (11- by 17-inch) output, for instance, only models from HP, Lexmark, QMS, Tally, and Tektronix can deliver. If you want automatic duplexing, only four models here will suffice. And if you want a tabloid printer that can duplex automatically, your only choice is the HP Color LaserJet 8500N, an Editors' Choice. This is the first color printer to deliver the speed, paper handling, and finishing options of a high-end monochrome network printer. Since its tabloid-size capability and duplexing let you create brochures, product guides, and other short-run color jobs that you previously would have had to send out to a print house, it will save you money in the long run.

Network managers, meanwhile, must pay close attention to setup, maintenance, and management issues during the selection process. Our satisfaction with setup varied from product to product. The best units we tested were from HP and Lexmark, whose utilities walked us through the network configuration process. Once the unit is up and running, you want to keep it that way. HP, Lexmark, and QMS lead the way with slick LAN- or browser-based management utilities that can locate a printer, check its status, and alert administrators of trouble or maintenance needs.

Also consider the obsolescence protection of one of the new Internet-ready printers (such as those from Brother, HP, NEC, and Tektronix). Such printers can accept print jobs via the Internet from any PC (or other properly configured sending device) anywhere in the world; see the sidebar "Internet Printing Is (Almost) Ready."

The color market is maturing. Gone are the liquid silicon oil bottles that leaked, the messy manual toner refills, and the drivers that all but required a fine arts degree. On the way out are high prices and painful setup routines. Networked color is now worth investing in, and if you choose carefully, you may be able to do away with the monochrome printers in your office.

Editors' Choice

• HP Color LaserJet 4500DN and 8500N

After three generations of acceptable but not great color laser printers, giant HP finally hit the nail on the head with these two models. If you need color output just up to legal size, our Editors' Choice is the HP Color LaserJet 4500DN (basic configuration, $2,500; tested configuration, $3,800). Its 16-ppm mono, 4-ppm color engine kept it at the front of the pack on our speed tests and produced fine color. But the real draw is the excellent software. HP's JetAdmin utility walks you through the setup and configuration of the printer on the network. One of the first printers to implement the Internet Printing Protocol, the 4500-DN can receive jobs via its IP address from any properly configured PC on the Web. Honorable mention goes to the QMS magicolor 2 DX (basic configuration, $2,200) and the Tektronix Phaser 740/DP (basic, $2,000; tested, $3,380). Both deliver good output and offer network tools almost as good as the HP has.

If you need tabloid-size (11-by-17) output, one printer stands above the rest: the HP Color LaserJet 8500N (basic configuration, $6,000; tested, $6,800). Its 24-ppm mono, 6-ppm color engine is quick enough for departmental use, and it delivers the same excellent management features as the 4500DN. What sets the 8500N apart from the other printers is its paper handling: It's the only oversize printer here that can be equipped with a duplexer ($399), so you can generate your own professional-looking product literature.

Honorable mention in the oversize category goes to the Lexmark Optra Color 1200n (tested configuration, $6,950). It was handily the fastest printer on most of our color speed tests, and Lexmark's MarkVision configuration and management utility is a match for HP's. Almost as likable are the tabloid entries from QMS (the $4,500 magicolor 330 EX) and Tektronix (the $6,400 Phaser 780/P).

Brother HL-2400CN

Legal-size 1,200- by 600-dpi laser printer; 16 ppm mono, 4 ppm color; basic configuration, $3,000 street; tested configuration, $3,128. Bridgewater, NJ; 800-276-7746; www.brother.com.

● The versatility of the Brother HL-2400CN color laser makes it a sensible choice for its intended markets: medium-size workgroups or small departments of 10 to 20 users. Reasonably straightforward to configure on a network for those with networking experience, it boasts good color print quality and was among the fastest in this roundup when printing text.

Setup and maintenance of the HL-2400CN is simple. Replacing toner and paper supplies is uncomplicated, and the reasonably clear LCD panel is a helpful aid in determining system status and changing configuration settings. Setting up the printer for a network calls for at least a moderate level of experience: Everything you need is included and it all works, but you have to make many manual settings. Once it's installed, you can use a browser (with network access) to query the machine locally or remotely to view status and make changes, using an on-screen representation of the printer's LCD panel. The bundled

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From printers to scanners to removable storage drives, PC Magazine Online is the best place on the Internet for comprehensive computer peripheral reviews. To learn more about color network printing, try these other sites.

➤**PC Technology Guide: Input & Output**
www.pctechguide.com/io.htm
This useful table of contents page includes direct links to extended, illustrated explanations of the technology behind laser printers, ink jets, and other printers (including solid-ink models).

➤**The Internet Engineering Task Force**
http://ietf.org
This somewhat dense, dry site discusses the latest efforts to set universal standards for data transmission on the Internet, including progress in standardizing and implementing an Internet Printing Protocol (IPP).

software also supports limited Internet printing from clients to Brother machines.

Color graphics and photo image prints were good enough for in-house purposes and slide presentations, though not as good as others (such as the HP and Tektronix models), in part because the printer doesn't support some kinds of glossy stock. On our speed tests, the HL-2400CN was one of the leaders in text printing, averaging over 11 ppm on our text-only test and 4.7 ppm on our mixed text and graphics text. In high-resolution color, its speed dropped to just below 1 ppm, average for the field. In general, this Brother entry is solid. But be sure to compare it with the similarly priced entries from HP, QMS, and Tektronix.—*Bruce Brown*

Canon BJC-6000

Legal-size 1,440- by 720-dpi ink jet; 8 ppm mono, 5 ppm color; basic configuration, $250 street; tested configuration, $380. Costa Mesa, CA; 800-652-2666; www.ccsi.canon.com.

● The Canon BJC-6000 ink jet printer is well suited for the small-office environment. Thanks to its parallel-port print server option from Axis Communications, it can serve as a low-cost network printer for small groups of no more than five to ten users. Look elsewhere for high-volume color network printing, but the Canon is a reasonable choice for light duty.

Novices will need help determining protocol information prior to install, but basically, configuring the BJC-6000 with Axis's ThinWizard Web-based Java utility was easy. The same utility is used to manage and troubleshoot Axis print servers locally and remotely, but it doesn't provide individual job control. The BJC-6000 is PCL-only and doesn't have Pantone support or a duplexing feature. It does have separate ink tanks for each color, though claimed cost per page for a typical color business document (11 cents) is still about 2 cents higher than for a color laser.

While text quality was more than acceptable, during lab testing we saw marked banding and relatively flat colors on dense graphics and photographic images (printed in default mode on plain paper). When loaded with Canon's glossy paper and an optional photo cartridge, however, photo output was superb. Compared with the heavy-duty laser printers in this roundup, the Canon was relatively slow at printing text, with average speeds ranging from 4 to 5 ppm. Graphics and photo printing speeds were closer to the norm for the group, at just over 1 ppm.

The BJC-6000 is an inexpensive way to add high-quality, light-duty photo printing capability to a small-office network.—*BB*

HP 2500Cxi, Color LaserJet 4500DN, Color LaserJet 8500N

HP 2500Cxi: Tabloid-size ink jet; 12 ppm mono, 10 ppm color; basic configuration (tested), $1,000 street. **HP Color LaserJet 4500DN:** Legal-size 2,400-dpi laser; 16 ppm mono, 4 ppm color; basic configuration, $2,500; tested configuration, $3,800. **HP Color LaserJet 8500N:** Tabloid-size 2,400-dpi laser; 24 ppm mono, 6 ppm color; basic configuration, $6,000; tested configuration, $6,800. Palo Alto, CA; 800-552-8500, www.hp.com.

PC MAGAZINE EDITORS' CHOICE

Hewlett-Packard's newest products offer excellent solutions for users and administrators alike. The 2500Cxi ink jet is ideal for departments where a color laser is too costly or for graphics workgroups that need stunning oversize output. The LaserJet 4500DN, our Editors' Choice for color output up to legal size, is designed for medium-size workgroups. The LaserJet 8500N, our Editors' Choice among tabloid-size printers, is the color laser we've been waiting years for: It has suffi-

PC MAGAZINE LABS SCORECARD

For the **setup** rating we take into account setting up the printer and configuring it on a NetWare or a Windows NT network.

The **administration** rating reflects the breadth and depth of the printer's network administration utility. We look for a wide range of reported alerts and conditions.

For **print quality** we judge how well the printer produces typical monochrome and color business documents both at its default settings and after we tweak the driver settings.

For **Paper handling** we consider the printer's standard paper capacity as well as options. The ability to print on oversize media is a plus.

In **Internet printing,** the best printers have implemented a version of the Internet Printing Protocol, while others are at least IPP-ready.

PC denotes Editors' Choice.	Setup	Administration	Print quality	Paper handling	Internet printing
Brother HL-2400CN	Excellent	Good	Excellent	Good	Excellent
Canon BJC-6000	Excellent	Good	Good	Good	Fair
HP 2500Cxi Professional Series	Excellent	Excellent	Excellent	Good	Excellent
PC HP Color LaserJet 4500DN	Excellent	Excellent	Good	Excellent	Excellent
PC HP Color LaserJet 8500N	Excellent	Excellent	Good	Excellent	Excellent
Lexmark Optra Color 1200n	Good	Good	Good	Good	Fair
Minolta Color PageWorks Ex	Good	Good	Fair	Good	Fair
NEC SuperScript 4400N	Fair	Good	Fair	Good	Good
Panasonic KX-P8420LX	Excellent	Fair	Good	Good	Fair
QMS magicolor 2 DX	Excellent	Good	Excellent	Good	Fair
QMS magicolor 330 EX	Excellent	Good	Good	Good	Fair
Tally SpectraStar T8204+	Poor	Fair	Good	Good	N/A
Tektronix Phaser 740/DP	Good	Excellent	Good	Good	Good
Tektronix Phaser 780/P	Good	Excellent	Excellent	Excellent	Good
Tektronix Phaser 840/DP	Excellent	Excellent	Good	Good	Good

N/A—Not applicable. The product does not have this feature.

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cient speed for an entire department, with paper-handling features previously available only on monochrome laser printers.

Even an inexperienced network administrator should be able to install and configure these printers using HP's JetAdmin or Web JetAdmin software. In our labs, the utility automatically detected all three printers, then walked us through a series of choices that had us up and running on Windows NT and NetWare in less than 15 minutes. Once you've got the printer running on your server, you can add Windows clients remotely. HP's administration and client tools can be used to access features and printer status, track jobs and maintenance needs, or cancel printing. They also have the ability to upgrade firmware in a browser. All three printers offer IPP (Internet Printing Protocol) support, which lets users print to these printers via the Web.

The HP ink jet (top) is fine for small workgroups. The HP laser or the Lexmark unit can each serve as your only printer.

The 2500Cxi can fully cover 13- by 19-inch paper. It carries four separate ink cartridges, each matched to a separate moving printhead that refills on the fly. These are coupled with a half-inch-wide, single-pass print swath. The unit was slower than average compared with the laser printers, but its print times were adequate for a small network and downright impressive by ink jet standards. For full-color PowerPoint slides, for instance, the 2500Cxi actually outperformed every laser but the Lexmark.

The 2500Cxi's color quality makes it a natural for any shop that needs photo-realistic output or handles transparencies (when used with HP's rapid-dry media, the printer produces overhead slides that are dry when they hit the tray). On our tests, the 2500Cxi produced very rich color and good detail on photos and PowerPoint slides. Text output at 600 dpi compared favorably with laser output at the same resolution. This unit works best with ink jet stock; on plain paper, color looked muted.

The 4500DN, a more traditional color network printer, is designed to support up to 25 users. Both the 4500DN and the higher-end 8500N perform automatic color calibration each time they go online, and both come with a Color Productivity Toolkit that aids in using color in Microsoft Office by selecting and using Pantone colors. The 4500DN, no slouch when it comes to performance, placed consistently among the top finishers on our speed tests.

Its output in PostScript mode was excellent when printing a long document with mixed text and graphics on high-quality paper. There was some degradation of embedded text within charts when printing the same job with PCL emulation. We did see very slight white ghosting around small red text on a black background, but the large black areas were smooth and solid. Photos on glossy stock resembled those in high-end magazines, with pleasing contrast and no noticeable banding.

For tabloid-size output, consider the 8500N. It features a whopping 60,000-page-per-month duty cycle (compared with 30,000 or less for most others here) and can be configured with an eight-bin sorter mailbox ($1,245) and a duplexer ($399).

Like the 4500DN, the 8500N was consistently a top finisher on our speed trials, running behind the top-finishing Lexmark and neck and neck with Tektronix's tabloid-capable laser. We found the 8500N's print quality equal to that of the 4500DN, and just a notch below the class-leading Tektronix lasers. The 8500N handled all of the fine detail in gradient fills; large solid fills printed cleanly, and photographs printed with the detail and tonal range of a high-quality magazine. This quality, plus the oversize output and duplex capability, means that businesses can produce their own short-run jobs on demand instead of having them outsourced to a print house. For this reason alone, the 8500N is worth the price. The great administration and Internet printing capabilities are gravy.—*JK*

Lexmark Optra Color 1200n

Tabloid-size 1,200-dpi laser; 12 ppm mono, 12 ppm color; basic configuration (tested), $6,950 street. Lexington, KY; 800-539-6275; www.lexmark.com.

● Lexmark's innovative Optra Color 1200n uses a unique in-line engine that delivers color printouts (up to 11 by 17 inches) at the same rated speed as monochrome printers. Indeed, it was the fastest unit on most of our tests, and Lexmark's administration utilities are second to none. But speed isn't everything, and the tabloid-capable HP LaserJet 8500N delivers the same level of administration savvy plus more robust paper-handling options (such as duplexing and sorting) for a competitive price—in our estimation, edging out the Lexmark.

Lexmark's impressive MarkVision administrative utilities provide thorough support for a wide range of network configurations. MarkVision supports NetWare bindery and NDS, as well as Windows NT; in addition, it includes an enormous range of TCP/IP-based options. It offers a near-automatic NetWare NDS and Bindery setup, plus above-average queue and consumables management. Lexmark's NetPNP is perhaps the slickest Windows NT printer setup utility we've seen: Working with DHCP, NetPNP automatically installs network printers onto a Windows NT server and handles all the Windows NT printer setup chores.

On speed tests, the Optra Color 1200n was the printer to beat. One reason for the Lexmark's speed on graphics jobs is its unique in-line print system. Lexmark's system of four separate printheads means that the paper simply travels one time along the paper path instead of around the drum four times (once for each color).

Color output at the printers default settings is good enough for business purposes, and by tuning the driver we were able to produce much better output, though the entries from HP and Tektronix produced still better output.

The 1200n is a fine choice for networks that need a speedy, tabloid-capable color printer. But do consider the HP LaserJet 8500N as well.—*David A. Harvey*

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HP ProCurve 9308M, 4000M, 2424M, 2224 and 1600M prices are U.S. list prices effective 3/1/99. Savings claims based on U.S. list prices effective 2/22/99 for Cisco 2948-G and Cisco Catalyst 8540, 3Com SuperStack II 3300 and 3Com CoreBuilder 9000, Bay 450T and Bay Accelar 1200 in a large network. *HP ProCurve 9300 Series products have a 1-year warranty with extensions available. Market growth source: Dell'Oro Q3, 1998 for worldwide layer 2 switched 10/100 shipments. ©Hewlett-Packard Company.

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PERFORMANCE TESTS

Color Network Printers

PC MAGAZINE LABS

The fastest printer overall was the Lexmark Optra Color 1200N, with the HP 8500N close behind.

PC Labs put these color network printers through a battery of tests to evaluate their performance in printing typical business documents. The 12-page **Microsoft Word Text and Graphics** test measures a printer's speed in producing a Word 97 document with heavily formatted text and graphics. By comparing these results with the 12-page Text-Only test data (where performance is largely a function of engine speed), we can expose the printer's ability to process graphical documents. Performance on this test can be attributed mainly to driver efficiency, to the printer CPU's rasterizing performance, and to network proficiency. Having more printer memory also helps reduce networking overhead in transporting print-job data. While most of its competition slowed to a crawl when more color graphics were added to the test document, the Lexmark Optra Color 1200n suffered hardly any performance degradation on this test. Much credit for the Lexmark's color prowess is due to its in-line engine, which requires only one pass to lay down all four colors, rather than the four passes needed by traditional color lasers.

For the 12-page **Microsoft Word Text-Only** test, we measured each printer's speed in producing a Word 97 text document consisting of pure unformatted text. This test is a good measure of a printer's first-page-out delay when printing small documents.

For the 43-page **Microsoft Word Text and Graphics** test, we sent to each printer a 43-page document consisting of mostly text and some simple, highly compressible graphics from Microsoft Word 97—typical of many moderate-size business reports.

We printed our 6-page **Microsoft PowerPoint Graphics** test from a PowerPoint 97 file that contained a good mix of text, graphics, and complex background patterns. For the **Adobe Photoshop Graphics** tests, we had the printers produce a full-color 8- by 10-inch photo in CMYK mode and another in RGB mode.

The **Microsoft Office Torture Test** suite is an obstacle course that simulates a real-world printing environment. We paused the printer and filled the queue with interleaving jobs from the IntranetWare and Windows NT servers. We then measured the printer's performance in handling jobs from various applications (Microsoft Word, Excel, and Publisher) that were sent through multiple network protocols (IPX and IP).—*Analysis written by S. Jae Yang*

▶ **The Lexmark Optra Color 1200n was the clear winner on the 12-page Microsoft Word Text and Graphics test, Microsoft PowerPoint Graphics test, Adobe Photoshop tests, and Microsoft Office Torture Test suite. Brother's HL-2400CN and HP's LaserJet 4500DN and LaserJet 8500N led the pack on the 43-page Microsoft Word Text and Graphics test, yielding better than 11 ppm. On our 12-page Microsoft Word Text-Only test, the HP LaserJet 8500N stood out from the pack with 12.2-ppm performance.**

▲ High scores are best; all results in effective ppm; denotes Editors' Choice

	Default Resolution (dpi)	Microsoft Word Text and Graphics (12 pages)	Microsoft Word Text-only (12 pages)	Microsoft Word Text and Graphics (43 pages)	Microsoft PowerPoint Graphics (6 pages)	Adobe Photoshop CMYK photo (tk in. by tk in)	Adobe Photoshop RGB graphic (tk in. x tk in.)	Microsoft Office Torture Test (9 simultaneous jobs, 75 pages)
Brother HL-2400c	600	4.7	11.4	**11.5**	2.5	0.9	0.7	5.4
Canon BJC-6000 (ink jet)	tk	2.9	5.2	4.4	N/A	1.1	1	N/A
HP DeskJet 2500c (ink jet)	300	3	5.7	5.1	1.8	1.4	1.4	4.5
HP LaserJet 4500dn	600	6.4	10.6	11.2	1.3	1	1	9.2
HP LaserJet 8500n	600	3.6	12.2	11.1	3	0.9	0.9	9.6
Lexmark Optra Color 1200	600	**8.7**	8.6	10.4	**6.5**	**1.6**	**1.8**	**11.3**
Minolta ColorPageWorks EE	1200x600	1.9	2.8	3	N/A	0.6	0.8	2.6
NEC SuperScript 4400n	600	3.8	10.9	8.8	1.9	0.9	0.9	5.7
Panasonic KX P8420	tk	2.9	7.8	9.3	0.3	0.6	0.6	6.8
QMS magicolor-2 DX	600	4.6	10.9	10.2	0.3	0.9	0.7	8.7
QMS magicolor 330	600	3.5	8.7	10.2	0.9	0.8	0.6	7.4
Tally T-8204 +	600	3.4	6.7	9.4	0.9	0.6	0.6	7.3
Tektronix Phaser 740	600	5.9	8.5	10.8	2.6	0.9	0.9	9.3
Tektronix Phaser 780 (solid ink)	600	5.3	7.1	9.9	2.2	0.7	0.8	5.1
Tektronix Phaser 840	400	2.5	2.5	2.3	2.3	1.2	1.1	2.8
Average:		4.2	7.8	8.5	2	0.9	0.9	6.8

N/A: Not applicable. The printer could not complete this test.

Minolta Color PageWorks Ex

Legal-capable 2,400- by 600-dpi laser; 12 ppm mono, 3 ppm color; basic configuration, $3,300 street; tested configuration, $4,280. Mahwah, NJ; 888-264-2658; www.minoltaprinters.com.

● The Minolta Color PageWorks Ex is targeted for a small workgroup or office. And at the right price, it could be a reasonable choice. Unfortunately, it costs more than some of the printers from HP, QMS, and Tektronix that offer faster speed, better network support, and equal or better image quality.

The manual gives enough information about network setup so that even a novice should be able to stumble through the directions, perhaps with a call to tech support. A knowledgeable network administrator should have no problems. For remote printer management, the printer uses EFI's WebTools, which is built into the EFI Fiery controller. WebTools offers a fairly capable spooler but provides only limited printer status information and lets you change only a limited number of printer controls. Minolta plans to add its own administrative software, PageScope, and make it available on the company's Web page, but it wasn't available for our review. Minolta does expect this printer to have full IPP support under Windows 2000.

Print quality is acceptable for business text, graphics, and photos. However, on our tests colors tended to be a little muddy, with graphics and photos showing some visible streaking. Note, too, that this was often the slowest printer in the roundup on speed tests and was one of only two units that couldn't print the sample PowerPoint file. Ultimately, other models here are better buys.—*M. David Stone*

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SUMMARY OF FEATURES See www.pcmag.com for interactive views

Color Network Printers

Continues

■ YES □ NO
Products listed in review order

	Brother HL-2400CN	Canon BJC-6000	HP 2500Cxi Professional Series	HP Color LaserJet 4500DN (PC MAGAZINE EDITORS' CHOICE)	HP Color LaserJet 8500N (PC MAGAZINE EDITORS' CHOICE)	Lexmark Optra Color 1200n	Minolta Color PageWorks Ex
Rated engine speed, monochrome/color (ppm)	16 / 4	8 / 5	9 / 3.5	16 / 4	24 / 6	12 / 12	12 / 3
Street price, basic configuration	$2,500	$250	$1,000	$2,500	$6,000	$6,950	$3,300
Street price, tested configuration	$3,270	$380	$1,400	$3,800	$6,800	$6,950	$3,660
Options included in tested configuration	32MB RAM, NIC, extra paper tray	PrintPoint print server, USB adapter kit	NIC	32MB RAM, duplexer, paper tray	2.1GB hard disk	None	NIC
Ethernet adapter	$450	$130	$400	Included	Included	Included	$360
Printer engine manufacturer	Hitachi	Canon	HP	Canon	Canon	Info not available	Minolta
Minimum/maximum RAM	16MB / 112MB	128K / 128K	4MB / 76MB	64MB / 208MB	32MB / 256MB	64MB / 128MB	80MB / 192MB
Claimed maximum resolution (dpi)	2,400	1,440 x 720	Info not available	2,400	2,400	1,200	2,400 x 600
RAM needed for maximum resolution	16MB	128K	4MB	64MB	32MB	64MB	96MB
Processor speed	100 MHz	Info not available	66 MHz	133 MHz	133 MHz	200 MHz	133 MHz
Highest PCL level supported	PCL 6	Info not available	PCL 3	PCL 5c	PCL 5c	PCL 6	N/A
Highest PostScript level supported	Level 2	N/A	Level 3 ($250)	Level 2	Level 3	Level 2	Level 3
PostScript emulation	Brother	N/A	Adobe	Xenographics	Xenographics	Lexmark	Adobe
Supports NetWare 4.*x* / 5.0	■■	□□	□□	■■	■■	■■	■□
Supports NetWare 4.*x* NDS	■	■	■	■	■	■	□
Supports Windows NT/Linux	■■	■□	■□	■□	■□	■□	■□
Print management utility included	BR-Admin	Axis print utility	JetAdmin	JetAdmin	JetAdmin	MarkVision	Minolta PageScope
Utility can control other brands of printers	□	□	■	■	■	■	■
Web-based management utility included	BR-Admin	None	Web JetAdmin	Web JetAdmin	Web JetAdmin	MarkTrack	Minolta PageScope
Remote messages:							
Paper low/Toner low	■■	□■	□■	■■	■■	■■	■■
Usage tracking by user or department	■	□	□	□	□	■	□
Supports Windows 95 / NT clients	■■	■■	■■	■■	■■	■■	■■
Supports OS/2 / Mac OS clients	□■	□□	■■	■■	■■	□□	□□
End-user applet provides:							
Thumbnail/booklet printing	■■	■■	■■	□■	■■	■□	□□
Job hold/Job preview/Reprint	□□■	■■■	□□□	□□□	□□□	□□□	□□□
Claimed cost per page:							
5 percent black coverage	4 cents	3 cents	1 cent	1 cent	1 cent	2 cents	2 cents
25 percent color coverage	8.9 cents	11 cents	25 cents	10 cents	9 cents	10 cents	13 cents
Rated duty cycle (pages per month)	24,000	Info not available	12,000	35,000	80,000	20,000	30,000
Number of standard paper inputs	1	1	3	3	3	3	2
Total standard capacity (pages, input/output)	250 / 500	130 / 130	400 / 400	900 / 350	1,100 / 600	600 / 250	400 / 250
Prints on ledger-size paper/Transparencies	□■	□■	■■	□■	■■	■■	□■
Interleaves blank pages between transparencies	□	□	□	□	□	■	□
Prints on envelopes	■	■	□	■	■	■	■
High-capacity paper cassette (sheets/price)	240 / $400	None	None	500/Included	500/Included	500/Included	None
Duplexer	None	None	None	Included	$400	None	None
Sorter	None	None	None	None	$1,245	None	None
Token-Ring adapter	Third-party	None	$400	$530	$530	$490	$540
Supports simultaneously active ports	■	□	■	■	■	■	□
Supports more than one installed NIC	□	□	■	■	■	■	□
Toll-free technical support	■	■	□	□	□	■	■

N/A—Not applicable: The product does not have this feature.

NEC SuperScript 4400N

Legal-size 1,200-dpi laser; 16 ppm mono, 4 ppm color; basic configuration, $2,500 street; tested configuration, $3,000. Itasca, IL; 800-632-4636; www.nectech.com.

● NEC's 1,200-dpi SuperScript 4400N is a color laser printer intended for small workgroups. An average performer with excellent Internet printing capability, its main drawback is the overly cumbersome network installation procedure.

To install the SuperScript in NetWare for either NDS or bindery, you must first use NetWare's tools, then use a separate printer utility to tell the printer's network card which server or tree to attach it to. Unfortunately, the instructions for this process are unclear, and it took a call to tech support to get it up and running. On the TCP/IP side, there's a decent utility that lets you enter the printer's MAC address and set up its IP address. But there's no built-in setup program for Windows NT.

NEC's PrintAgent technology provides excellent Internet printing features. After installing a standard driver, you can print to any printer in the world (as long as it has a valid IP address). Thanks to a bundled Web server, you can also connect to any printer over the Internet and then use

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SUMMARY OF FEATURES — See www.pcmag.com for interactive views

Color Network Printers

Ends

■ YES □ NO Products listed in review order	NEC SuperScript 4400N	Panasonic KX-P8420LX	QMS magicolor 2 DX	QMS magicolor 330 EX	Tally SpectraStar T8204+	Tektronix Phaser 740/DP	Tektronix Phaser 780/P	Tektronix Phaser 840/DP
Rated engine speed, monochrome/color (ppm)	16 / 4	14 / 4.7	16 / 4	16 / 4	16 / 4	16 / 5	16 / 4	10 / 10
Street price, basic configuration	$3,000	$4,400	$2,200	$4,500	$4,050	$3,380	$6,390	$3,070
Street price, tested configuration	$3,000	$4,400	$2,200	$4,500	$4,950	$3,380	$6,390	$3,420
Options included in tested configuration	None	None	None	None	128MB RAM, 2.2GB hard disk	None	None	64MB RAM
Ethernet adapter	Included	Included	Included	Included	Included	Included	Included	Included
Printer engine manufacturer	Hitachi	Matsushita	Hitachi	Hitachi	Fuji-Xerox	Matsushita	Fuji-Xerox	Tektronix
Minimum/maximum RAM	96MB / 128MB	80MB / 192MB	80MB / 384MB	48MB / 384MB	64MB / 384MB	128MB / 256MB	192MB / 192MB	64MB / 128MB
Claimed maximum resolution (dpi)	1,200	1,200	2,400 x 600	1,200	1,200 x 600	1,200	1,200	1,200
RAM needed for maximum resolution	96MB	80MB	80MB	88MB	88MB	64MB	64MB	64MB
Processor speed	100 MHz	133 MHz	133 MHz	150 MHz	150 MHz	133 MHz	133 MHz	133 MHz
Highest PCL level supported	PCL 5e	PCL 3	PCL 6	PCL 5c	PCL 5c	PCL 5c	PCL 5c	PCL 5c
Highest PostScript level supported	Level 3	Level 3	Level 2	Level 2	Level 2	Level 3	Level 3	Level 3
PostScript emulation	Adobe	Adobe	Adobe	Adobe	Tally	Adobe	Adobe	Adobe
Supports NetWare 4.x / 5.0	■■	■□	■■	■■	■□	■■	■■	■■
Supports NetWare 4.x NDS	■	■	■	■	□	■	■	■
Supports Windows NT/Linux	■□	■□	■■	■■	■□	■■	■■	■■
Print management utility included	M.A.P.	WebTools	Crown Systems	Crown Admin3	Crown Admin3	PhaserLink	PhaserLink	PhaserLink
Utility can control other brands of printers	□	■	■	■	■	□	□	□
Web-based management utility included	PrintAgent	WebTools	CrownView	CrownView	CrownView	PhaserLink	PhaserLink	PhaserLink
Remote messages:								
Paper low/Toner low	■■	■■	■■	□■	■■	□■	■■	□■
Usage tracking by user or department	□	■	□	□	■	■	■	■
Supports Windows 95 / NT clients	■■	■■	■■	■■	■■	■■	■■	■■
Supports OS/2 / Mac OS clients	□■	□■	■■	■■	■■	□□	□□	□□
End-user applet provides:								
Thumbnail/booklet printing	■□	■■	□□	■□	■■	■□	■□	■□
Job hold/Job preview/Reprint	□□□	■■■	■■□	■□■	□□■	□■□	□■□	□■□
Claimed cost per page:								
5 percent black coverage	2 cents	3 cents	2 cents	2 cents	2 cents	2 cents	3 cents	3 cents
25 percent color coverage	10 cents	12 cents	13 cents	13 cents	13 cents	15 cents	17 cents	11 cents
Rated duty cycle (pages per month)	20,000	25,000	20,000	12,000	12,000	100,000	12,000	65,000
Number of standard paper inputs	1	2	2	5	2	2	2	1
Total standard capacity (pages, input/output)	250 / 250	850 / 500	250 / 250	250 / 250	400 / 400	350 / 500	400 / 400	200 / 500
Prints on ledger-size paper/Transparencies	□■	□■	□■	■■	■■	□■	■■	□■
Interleaves blank pages between transparencies	□	□	□	□	□	■	■	■
Prints on envelopes	■	■	□	■	■	■	■	■
High-capacity paper cassette (sheets/price)	250 / $450	250 / $130	500 / $480	750 / $900	750 / $810	250 / Included with duplexer	750 / $695	500 / $495
Duplexer	None	None	None	None	None	$695	None	Included
Sorter	None	None	None	None	None	None	None	None
Token-Ring adapter	None	$660	$650	$650	$590	$580	$580	$580
Supports simultaneously active ports	■	■	■	■	■	■	■	■
Supports more than one installed NIC	□	□	■	■	■	□	□	□
Toll-free technical support	■	■	■	■	□	■	■	■

a "push" feature to send files directly to it.

On our tests, the SuperScript managed one of the fastest speeds on our short text file (almost 11 ppm) but was about average on all other measures. We found the output from this printer to be average and more than adequate for business graphics. Text was excellent, as expected for a laser printer.

In general, this is a fine business printer and ahead of the pack for Internet printing. Alas, its network installation procedure could use an overhaul.—*DAH*

Panasonic KX-P8420LX

Legal-capable 1,200-dpi laser; 14 ppm mono, 4.7 ppm color; basic configuration (tested), $4,395 street. Secaucus, NJ; 800-742-8086; www.panasonic.com/monet.

● The Panasonic KX-P8420LX is a good fit for a small to medium-size workgroup or office. It can also serve a department as a second printer for color. The KX-P8420LX is a vast improvement over the KX-P8410 that we saw last year, and it certainly belongs in the running.

On our tests, setup on our NetWare and Windows NT networks was arduous because of a lack of documentation. Panasonic, however, has recognized that the manual omits too much information even

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Internet Printing Is (Almost) Ready

Think that your output options are limited by the length of your network cables? Think again. The next generation of network printers (and a handful in the current crop) can print documents sent to them not just via a LAN, but also via the Internet from anywhere in the world. Is your colleague on the road? You could send a print job to the printer at his hotel instead of sending a fax. Need to get ten copies of a report to a branch office? Send the document directly to the remote office's printer and forget FedEx.

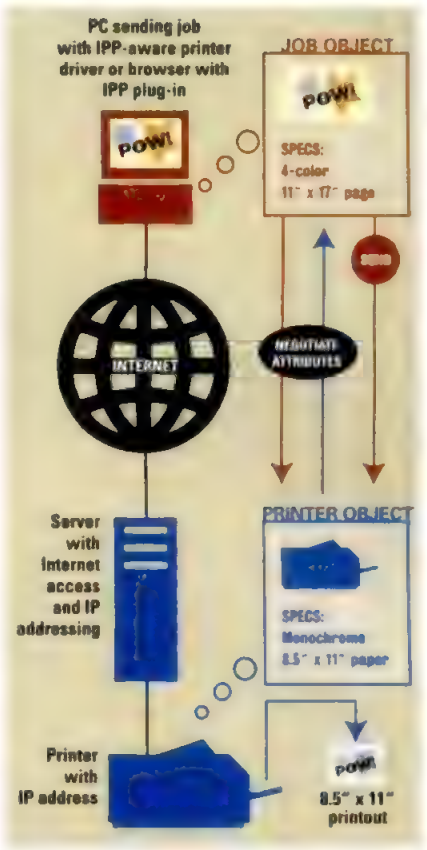
All this is possible because of the Internet Printing Protocol (IPP). This developing open standard will enable remote-control printing over the Internet to any IPP-compatible device, using only a Web browser and by typing in an IP address. IPP is a group effort of the Internet Engineering Task Force (IETF, *www.ietf.org*).

The concept is simple: A printer with a reachable IP address is an object; a print job, another object. Parameters like paper size, printer language, and number of copies are the attributes assigned to those objects. With the right drivers or browser plug-ins, someone who wants to print to a remote location can check on a printer's availability and then send and track the job—whether on a LAN or around the world. Also, newsletters and document updates can be sent on demand to distribution points via push technology.

A few vendors have already released products that support IPP, and all of the HP printers in this review can receive IPP jobs, even though the standard is not yet final. We found the HP solution easy enough to use, comparable to a regular network installation, though we did have to upgrade the firmware on the printer's network card.

In practice, the send unit locates the recipient, then negotiates the best-quality output (such as PostScript versus plain text and attributes such as color or monochrome) and sends the job. And the sending device need not be a PC: Scanners, copiers, and other devices could be configured to send jobs via the Web. In addition to HP, solutions from NEC, Sun, Xerox, and others are here or close to release.

If you're shopping for a new color printer, it may be worth checking out just how far its virtual network connection really reaches.—*JK*



for knowledgeable network administrators and has written a supplement with step-by-step instructions to make the task easier. The supplement should be shipping with the printer soon. The instructions assume some prior knowledge of networking but are detailed enough that even a newcomer should be able to set up the printer.

Once set up, the printer, which uses a proprietary Fiery-driven controller, relies on the Fiery Web-page–based WebTools for remote management. WebTools offers a fairly capable spooler but is otherwise lacking. You can use it to change a limited number of printer settings and see some status information, including reports on jams. It's missing some important information, however, such as indicating how much paper is left. Note that you can set an administrator password so that users can't change settings.

Print quality is easily good enough for business-level text, graphics, and photos. The only flaw worth mentioning is slightly muddy colors. In general, performance was more than acceptable. The KX-P8420LX was far slower than all but one other printer on the PowerPoint test, but otherwise it scored in the mid to upper tier on the speed tests. Consider it a credible choice, but also consider entries from HP, QMS, and Tektronix.—*MDS*

QMS magicolor 2 DX, 330 EX

magicolor 2 DX: Legal-size 2,400-dpi laser; 16 ppm mono, 4 ppm color; basic configuration, $2,300 street. **magicolor 330 EX:** Tabloid-size 1,200-dpi laser; 16 ppm mono, 4 ppm color; basic configuration, $4,500. Mobile, AL; 800-523-2696; www.qms.com.

● The QMS magicolor line has consistently been the price leader among color lasers, and these models are no exception: The QMS magicolor 2 DX is the lowest-cost legal-size laser we tested, and the QMS magicolor 330 EX is the least expensive among tabloid-capable lasers. And QMS offers "LX" configurations for $500 less than the models we tested. Both are most appropriate for small to medium-size workgroups or offices. Most important, both are very much worth considering.

Network setup for both printers is best described as "easy if you know how." The Getting Started guide assumes that you already know how to use NWAdmin to set up a printer under NetWare, and it doesn't explain the choices or give many details for setup under Windows NT. Even an experienced Windows NT network administrator may need to call the toll-free tech-support line. A network novice will be lost without tech support's help.

For remote management, you can use QMS's CrownAdmin 3 software, telnet, or the built-in CrownView Web pages by way of a browser. Each choice offers different capabilities. You can, for example, change a small subset of printer settings with CrownView or change any of them through CrownAdmin 3 or telnet commands. On the whole, the remote management tools are first rate, and QMS plans to have full IPP support under Windows 2000 for both printers.

The magicolor 2 DX offers excellent output quality for business documents. On our tests, edges on graphics and text were suitably crisp; both gray-scale and color fills were solid and even; graphics offered bright, fully saturated colors; gradients in both graphics and photos changed gradually; and colors in photos were well within a realistic range. On our speed tests, the magicolor 2 DX scored in

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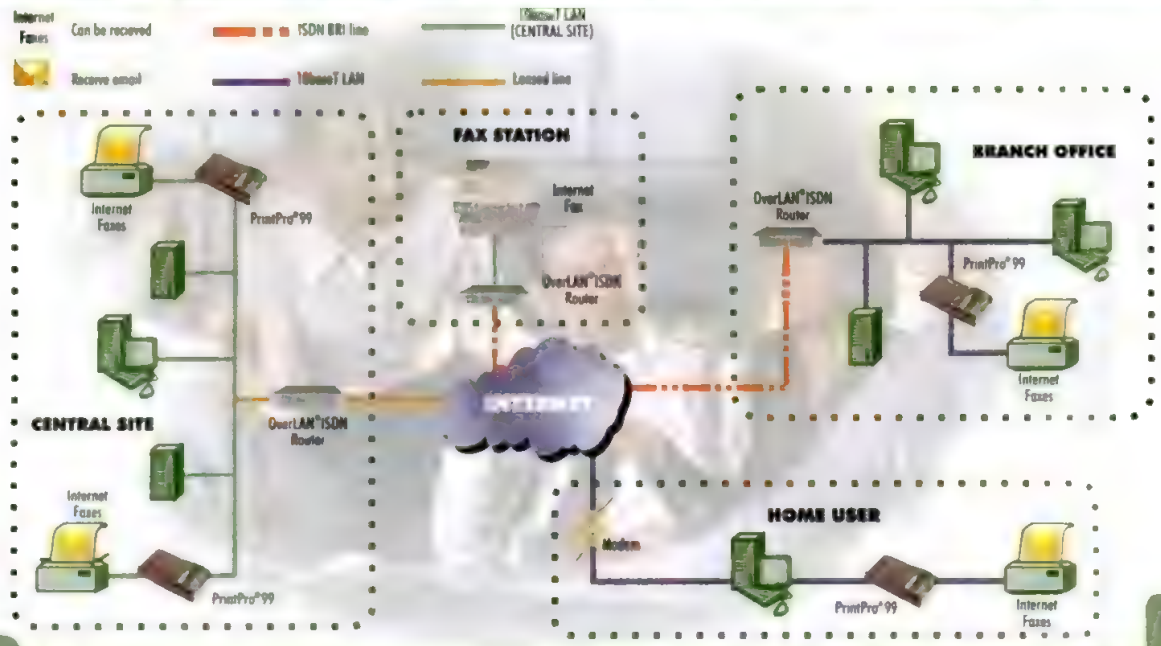

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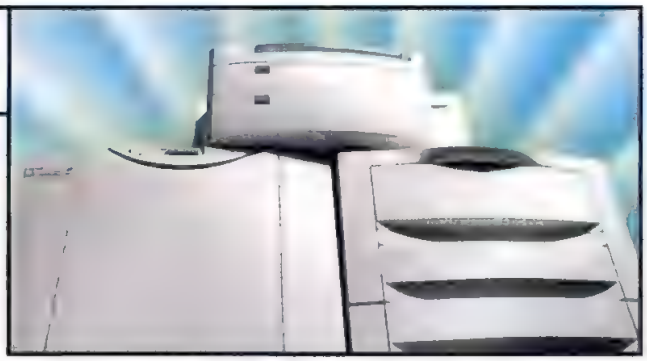
the mid-to-upper tier except for the Microsoft PowerPoint test, where it trailed the field. Still, the affordable magicolor 2 DX is a more than sensible choice, especially if higher-priced units are out of financial reach.



The Tektronix trio of printers delivered the best color output in the roundup.

The magicolor 330 EX rates a tad below the magicolor 2 DX for output quality, but it's still within the good-to-excellent range for business documents. It handled text, graphics, and photos well enough, but we saw slight banding in some gray-scale fills. Compared with the magicolor 2 DX, it produced colors that were less vibrant for graphics and less realistic for our test photos. The magicolor 330 EX's speed is comparable to that of other tabloid-size printers. It was consistently slower than the HP Color LaserJet 8500N, however—in some cases significantly so. But it was generally in the mid to upper tier of all printers tested. Clearly, if you need a tabloid-size color printer, the magicolor 330 EX should be on your list of finalists.—*MDS*

Tally SpectraStar T8204+

Tabloid-size 1,200-dpi laser; 16 ppm mono, 4 ppm color; basic configuration, $4,050 street; tested configuration, $4,950. Kent, WA; 800-843-1347; www.tally.com.

● The Tally SpectraStar T8204+ is a full-bleed tabloid-capable printer aimed at the professional graphics market, focusing on workgroups of 2 to 50 users. The Plus model we tested comes with 192MB of RAM (expandable to 384MB) and a hard disk—both optional on the 600-dpi basic model. A relabeled edition of the QMS magicolor 330 EX, it offers several features that will appeal to its intended users, though printers from HP and Tektronix offer better speed and output quality.

Hardware installation is straightforward even for relative novices, but we found network setup difficult because of the anemic product documentation. After setup, things get better. Tally provides QMS'S Web-based management tools on the CD in the box instead of making you download them. QMS's CrownAdmin lets you use any major Internet browser to control all printer settings, track jobs, and check consumable status and all the other features expected in a shared environment.

Print quality was mixed. Color was vivid, but the very shiny toner makes it hard to see fine text, especially in light colors or when placed over a colored fill. On the plus side, bitmaps and gradient fills looked very good, and the unit is compliant with ColorSync color matching.

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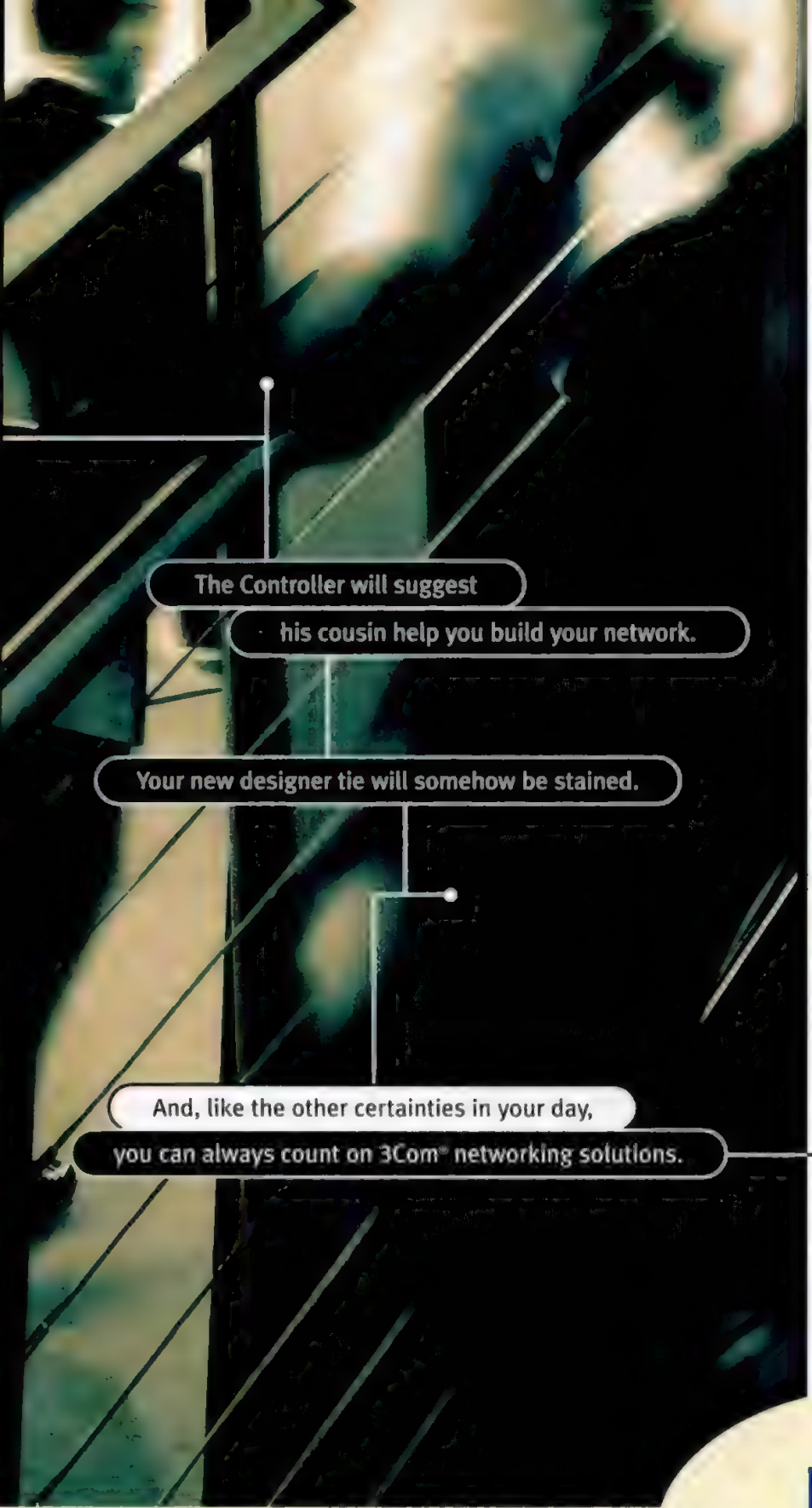

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On speed tests, the SpectraStar ran a bit below average on many tasks but was not alarmingly slow except on our Microsoft PowerPoint test, during which speed dropped significantly (as it did with the QMS magicolor 330 EX). Still, this Tally unit is a respectable (though not flawless) entry for those who need oversize output.—*JK*

Tektronix Phaser 740/DP, Phaser 780/P, Phaser 840/P

Phaser 740/DP: Legal-size 1,200-dpi laser; 16 ppm mono, 5 ppm color; basic configuration (tested), $3,600 street. **Phaser 780/P:** Tabloid-size 1,200-dpi laser; 16 ppm mono, 4 ppm color; basic configuration (tested) $6,390. **Phaser 840/P:** Legal-size 1,200-dpi solid ink; 10 ppm mono, 10 ppm color; basic configuration, $3,200; tested configuration, $3,890. Wilsonville, OR; 800-835-6100; www.tektronix.com.

● Tektronix has a clear strategy for attacking the high-end color printer market: Offer a range of technologies and configurations that appeal to a cross section of business users. The Tektronix Phaser 740/DP and 780/P are fine color laser printers that should be on your short list. And unlike solid-ink printers of yore, the Tektronix Phaser 840/P is well-suited to general office use; it's not solely a dedicated color printer for presentations and the like.

All three printers rely on the same network management software. Tektronix's PhaserLink is designed for use with Windows NT installations and makes it easy to set up and control shared printers. Since PhaserLink relies on Windows client spooling, there's no need to set up queues on a server. For NetWare installations, Tektronix includes Phaser Shared Administrator software, which provides almost the same range of features as PhaserLink.

You can also communicate directly with any of these printers by using its TCP/IP address (assigned by DHCP, if available) and any Web browser. This feature makes it easy to monitor and configure the device from across the room or across the country. Most users with a basic understanding of how a network functions will be able to set up a network installation for any of these printers. In addition to its management capabilities, the Tektronix software conveniently supports the use of POP3 and SMTP e-mail protocols to get print jobs past network firewalls.

Tektronix set the color printer market on its ear last year with the release of the Tektronix Phaser 740 line. The 740L/N monochrome printer was "color-capable" and had a street price of about $1,500, while the 740/N model was full-color and network-ready for just under $2,000—about the price of a high-end ink jet printer just a year or two ago. We tested the 740/DP model, which includes duplex support.

The 740/DP's print quality is excellent for business use. During testing, the printed output showed no evidence of banding on large solid areas or posterization on continuous-tone images. Its plain-paper performance was good, but with high-quality paper and glossy stock, the 740/DP produced exceptional results. The printer is relatively fast across the board; it placed in the top five or better on almost every test. Price is the real advantage of the 740/DP, but you don't have to sacrifice output quality to save money.

The Tektronix Phaser 780/P is clearly the big brother of the 740/DP model. Also a color laser, it has the distinction

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of handling paper up to 13 by 19 inches, making the unit capable of full-bleed 11-by-17 prints.

In our labs, the Tektronix Phaser 780/P produced excellent-quality output for business applications. Photographic images were sharp and realistic, especially on glossy paper, and there were no hints of banding or other artifacts on large areas of toner. The 780/P was not the fastest printer in the group, but it was generally in the top half of the pack, often within close reach of the leaders. Consider this printer if you need to print tabloid pages; it's a strong competitor in this narrow class.

The 840/P uses solid-ink technology. Tektronix continues to supply the black ink free, thus encouraging users to rely on the printer for all print jobs, not just color. The single-pass printhead uses variable dot size and positioning to enhance image quality, with up to 1,200- by 600-dpi resolution (1,000-by-500 in the basic configuration). Our evaluation unit, a Plus model, had an additional 64MB of memory, bringing the total to 128MB. Although 64MB alone is sufficient to print a page at full resolution, the extra memory improves print job pipelining and print speed.

In our labs, we saw print quality well suited for business applications, with nicely saturated colors. Low-resolution output on plain paper was excellent for charts and graphs and passable for photographs and continuous-tone images. Full-resolution output, especially on glossy paper, was a match for most color lasers. On our speed tests, the 840/P posted the slowest scores by far in the roundup for monochrome text printers—never reaching the 3-ppm mark—but was a good performer on color tests compared with the competition. Steady performance and low per-page consumable costs make the 840/P a serious contender.

In short, chances are that there is a Phaser that matches your needs. If you need to control per-page costs and get good speed on color and monochrome jobs, the 840/P is worth a look. For tabloid jobs, put the 780/P on your prospective list. And for a general-purpose, do-it-all printer at a trend-setting price, the 740/DP is the one to beat. —*Alfred Poor*

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TIPS, TRICKS, TOOLS, AND TECHNIQUES FOR YOU AND YOUR PC

SOLUTIONS

TUTOR

A Serial Bus on Speed

IEEE 1394 is poised to deliver lightning-fast serial connections to the latest breed of PC peripherals.

By Neil Randall

The dream of a quick, reliable way to connect multiple peripherals remained tantalizingly out of reach until recently. Though the IEEE 1394 High Performance Serial Bus has been around for some time, lack of vendor support left it languishing in the shadows, particularly as another standard—Universal Serial Bus (USB)—took off. Now 1394-ready peripherals are slated to appear later this year. Do we need another serial-connection standard? Let's take a look.

Universal Serial Bus is a great idea, but it suffers from one problem: It's too slow. For many peripherals, ranging from keyboards to biometrics units, it works just fine. But for high-speed peripherals such as digital camcorders, remote drives, and high-performance printers, USB's maximum data-transfer rate of 12 megabits per second (Mbps) simply isn't fast enough. The idea behind USB—a serial bus that lets you connect multiple peripherals at the same time—remains attractive, so a faster bus that works similarly is bound to supplement it.

In fact, 1394 is the solution. The name comes from its published specification. It's also called the FireWire bus, a nickname trademarked by Apple, which developed the bus in the early 1990s and now includes it on high-end Apple Macintoshes. (Sony has introduced still another name, i.Link, for use with its 1394-compliant devices.)

This is the year when 1394 should really start to catch fire. Electronics giants Apple, Compaq, Matsushita (Panasonic), Philips, Sony, and Toshiba recently announced support for the interface in their products, and Apple's Steve Jobs has said, "IEEE 1394 is poised to become the most widely used industry standard to interconnect consumer electronics and personal computer devices."

FireWire peripherals already available include digital video and audio equipment. Hard disks and DAT, DVD, and CD-R drives should also be available by the time you read this. Soon to appear are more consumer electronics devices, including digital video recorders from Panasonic and Sony, HDTV televisions from Samsung, set-top boxes from Mitsubishi, and music synthesizers from Yamaha.

All of these devices will work on PCs equipped with an IEEE 1394 port, but thus far PC manufacturers lag behind Apple in that they haven't been including 1394 ports on their motherboards (controller cards do exist, however).

The 1394 specification was designed to replace the SCSI bus; eventually, it may even replace PCI. The Apple iMac already uses USB in place of the company's traditional SCSI, and the Apple Power Mac-

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USER TO USER

Excel's pivot tables can replace complex cross-tabulation formulas; installing Windows 3.1 programs on Windows 95; creating calendars in Word 97; a glitch in Access 97 permits empty fields. *Page 207.*

UTILITIES

ClipTrak remembers the last 100 items you've copied or cut to the Clipboard. It maintains a cache from which you can choose to reuse or delete old Clipboard information. A tray menu and hotkey give you access to ClipTrak's features. *Page 215.*

ENTERPRISE COMPUTING

How secure is it to conduct business over the Internet? We discuss two major security holes: DNS spoofing and attacks exploiting dial-up connections. We also show you a top-down approach to securing your company's use of the Internet. *Page 217.*

PC TECH

Microsoft Office 2000 Developer Edition is a collection of tools for building and deploying custom Office applications. Find out what's new and improved over Office 97 Developer Edition and whether or not the package is right for you. *Page 221.*

ILLUSTRATIONS BY JEAN TUTTLE

intosh G3 combines USB and FireWire ports to achieve the same end. Given the much less universal use of SCSI on PCs than on Macs, a similar combination of USB and 1394 could easily replace the older technology on all but the most high-end servers. For home and small-office PCs, as well as notebooks and subnotebooks, a USB/1394 combination could provide a convenient way of connecting a wide variety of devices.

THE BENEFITS OF THE BUS

The 1394 bus is faster than the USB and most versions of SCSI. Soon, it will approach or exceed the speed of PCI. But speed, while valuable, isn't the only thing the 1394 has going for it. Here is a short list of benefits:

- *Mix and match.* The 1394 bus can simultaneously support devices of different speeds. Currently, the slowest device determines the speed of the entire bus, but future amendments to the specification allow for devices to operate at their designed speeds.
- *Hot pluggable.* You can plug and unplug 1394 devices without shutting down the bus or the computer. The bus reconfigures itself when new devices are added. The 1394 bus automatically detects new devices and also automatically terminates them; termination has always been a user nightmare with SCSI.
- *Standard cables.* SCSI users often have to worry about which cable to use; 1394 users do not. Cables are thin and thus easily placed where you want them.
- *Expertly tested connectors.* Durable and easy-to-use connectors take their design primarily from the Nintendo GameBoy, which has been thoroughly tested over the years by those who frankly don't give a damn about issues such as fragility (which is as it should be).
- *Easy configuration.* In fact, there is practically none at all. The devices and the computer take care of configuration.
- *Power from the cable.* The 1394 bus can carry power to low-power peripherals. The result should be lower-cost devices, since they won't need a dedicated power supply.
- *Isochronous and asynchronous support.* Isochronous guarantees bandwidth for devices that require it (live audio/video, for example). Asynchronous is more traditional on PCs, with each device waiting its turn.
- *Based on an open standard.* The IEEE standard is not proprietary.

THE DEFINITION OF SPEED

What does the specification mean by high performance? The bus must be able to handle devices of three different speeds: 100, 200, and 400 megabits per second. Only the device speeds differ; the 1394 bus itself supports all these speeds—although for now the overall speed of 1394 is limited to its slowest device.

Two supplements to the specification, 1394a and 1394b, bring bus speeds up through 800 Mbps to an eventual 3.2 Gbps. At even 400 Mbps, the bus can handle uncompressed video of 640 by 480 pixels and 30 frames per second and still have enough bandwidth to carry high-quality, 16-bit, stereo audio signals along with the video.

Compared with USB's capability of only 12 Mbps, then, 1394 is fast. But what about other buses? Figure 1 shows how 1394's speed stacks up against a variety of other bus types designed to handle external peripherals. Note that all speeds are expressed in terms of megabytes per second (MBps), even when the industry-standard measurement for that bus type is megabits (8 bits equals 1 byte).

One important point to keep in mind is that not all the buses or ports in Figure 1 are designed for the same purpose. Some, such as USB, SCSI, and the serial and parallel ports, primarily support external devices, while ISA, PCI, and AGP primarily support internal devices. IEEE 1394 supports both: The cable specification for 1394 covers the bus's connection to external devices, while the backplane specification covers internal connections.

The primary difference between the two is speed: FireWire can connect internally only at 100 Mbps, not at the higher speeds of 200 and 400. As a result, its uses are limited, but even at that speed it could handle a device comparable to a Fast SCSI hard disk. In this Tutor, we'll look only at the cable version of the bus, because the vast majority of the design and implementation work to date has been in that direction.

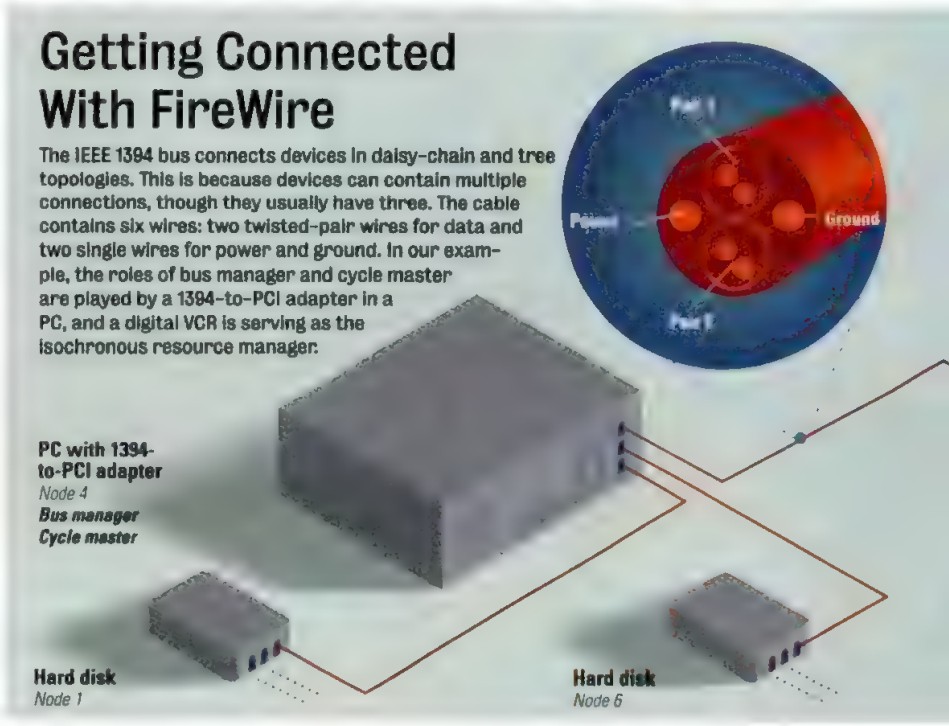
WHAT'S IN A 1394 SYSTEM?

The 1394 bus is described in the specification as a "noncyclic network with finite branches," and the cable bus is made up of nodes (addressable devices) and bus bridges, which link separate segments of devices together. The noncyclic part of the description means that you may not plug devices together so that you have created a closed loop.

Finite branches refers to the built-in limit to the number of cable hops—16—that can exist between the two nodes on the bus that are farthest apart. This means that 16 nodes can be daisy-chained together in one bus segment, and since each cable is limited to 4.5 meters, the maximum possible total cable length is 72 meters. But because the spec allows multiple connections on each device, you're not likely to see this kind of daisy-chained configuration. Instead, systems will typically use a tree topology (see illustration) rather than a daisy-chain topology.

Getting Connected With FireWire

The IEEE 1394 bus connects devices in daisy-chain and tree topologies. This is because devices can contain multiple connections, though they usually have three. The cable contains six wires: two twisted-pair wires for data and two single wires for power and ground. In our example, the roles of bus manager and cycle master are played by a 1394-to-PCI adapter in a PC, and a digital VCR is serving as the isochronous resource manager.



The cables themselves consist of six wires each, two twisted-pair wires for data and two single wires for power and ground respectively (see illustration). To make the 1394 bus operate properly, each node repeats signals from the bus continuously, and the cables themselves operate as repeaters to help guarantee the functionality of the bus at all times.

The 1394 bus's ID numbering system for nodes allows for a total of 63 nodes to be connected to a bus bridge, which connects bus segments together and allows communication among the various segments. One example of a bus bridge is a 1394 peripheral card in a PC; practically speaking, this means that an individual PC can have 63 devices attached to it through the 1394 bus. But one PC's bus segment can be connected to another PC's bus segment by means of still another bus bridge, allowing for double that number of devices to work together. In fact, the ID numbering system for buses allows for a whopping total of 1,023 bus bridges in a full 1394 network. At 63 devices per bus bridge, that means—well, you'll soon need a much bigger study.

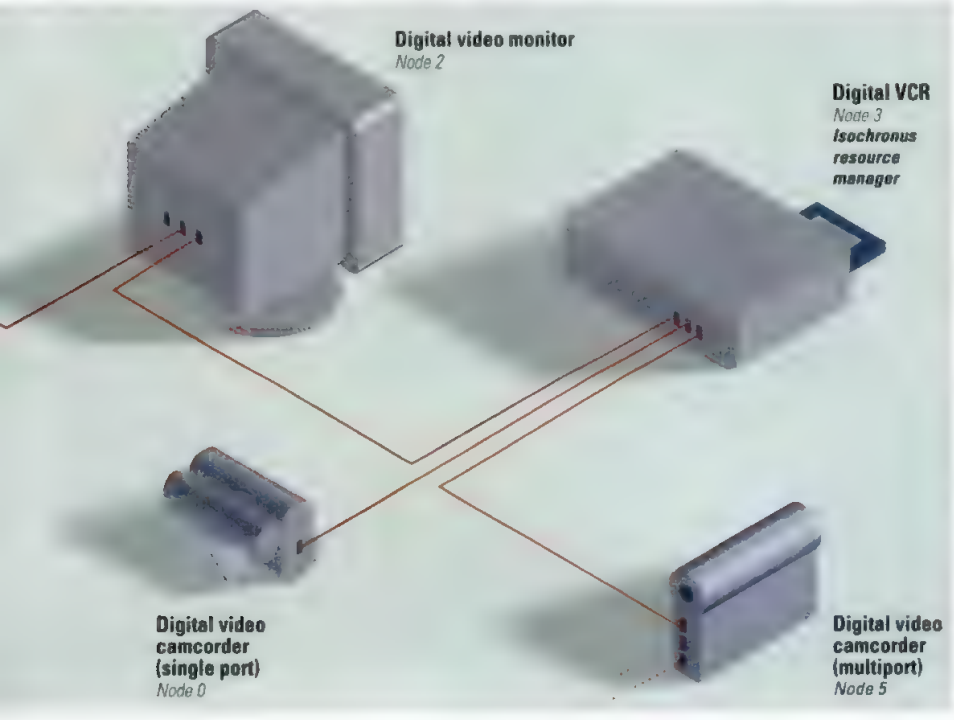
On the 1394 bus, three roles must be fulfilled by one or more nodes: There must be a *cycle master,* a *bus manager,* and an *isochronous resource manager.* The cycle master initiates the bus events and starts the packet flow for each event. The bus master keeps track of the topology (layout) of the bus and the optimization of speed and performance (among other duties). The isochronous (Greek for "equal time") resource manager is in charge of assigning channels and bandwidth for isochronous data transfers (see below). The 1394 bus can function both asynchronously and isochronously, and most devices will be built to operate in both modes as well. A node controller provides coordination of these services at the local level; each node has its own node controller.

BUS TYPE	MAXIMUM SPEED (MBps)
Parallel port (unidirectional)	0.0050–0.015
Serial port (16550 UART)	0.0144
Parallel port (bidirectional)	0.01–0.0375
Serial port (16650/16750 UART)	0.02875–0.0575
USB	1.5
Parallel port (EPP)	2
SCSI	Regular, 5; wide, 10
ISA (16-bit)	8
SCSI (Fast)	Regular, 10; wide, 20
SCSI (Ultra)	Regular, 20; wide, 40
IEEE 1394	50
SCSI (Ultra-2)	Regular, 40; wide,80
IEEE 1394a (near future)	100
PCI (32-bit)	133
PCI (64-bit, future)	267
AGP	267
IEEE 1394b (future)	200–400
AGP 2X	533
AGP 4X (future)	1,067

FIGURE 1: *A comparison of interface speeds. Data transfer rates are ordered from slowest to fastest. Bus types with two values are ordered according to the higher value.*

Asynchronous mode, which is used for many computer operations today, means that all devices on the bus share the bandwidth, with each device sending packets that queue up at the controller for acknowledgment. All data waits its turn. By contrast, in isochronous data transfer, a device lets the isochronous resource manager know that it needs to send data at a specific rate, requesting the necessary bandwidth to be dedicated to that transfer. The manager negotiates with the other devices, effectively restricting them to the bandwidth left over after the requesting device gets its wish. Once the negotiation is done, the requesting device owns the bandwidth for the time of the transfer; furthermore, because no packet acknowledgment takes place (there's no need for it, since only one device is sending), isochronous transfers are faster than asynchronous ones. Isochronous mode is in many ways the one essential component of the 1394 bus, because high-bandwidth technologies such as multimedia can transfer data with neither hesitation nor interruption. The danger of isochronous transfers hogging too much bandwidth for an unacceptable length of time is currently being addressed by proposals for amendments to the 1394 specification.

Whenever a device is plugged in or disconnected, or when power is cut off from the bus, a bus reset occurs, causing a reconfiguration of the entire bus, and a reassignment of node functions. The bus assigns these functions according to a fairly complex set of considerations, including the ability of a node to perform each function, and whether or not the node had a specific function before the reset. The node that most recently operated as the bus master, for example, is given first crack at being bus master again; if the node is still on the bus and returns the correct signals, it will remain bus master.



TIME TO PLUG IT IN

The 1394 spec is a welcome arrival to anyone who has struggled at configuring devices and their adapter cards, and it's even more attractive to network administrators who have to maintain dozens, hundreds, or even thousands of devices across complex networks. Early 1394-capable devices won't be cheap, though, since the electronics needed at the device level for 1394 will initially cost more than current technologies. But given the growing acceptance of the new bus, it seems only a matter of time until the standard for PCs will be a USB/1394 combination for practically all external peripherals, at which times prices will inevitably drop. Just think: Plugging in peripherals is actually getting to be fun. PC

Neil Randall is a contributing editor of PC Magazine.

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Pivot Tables to the Rescue

For billing purposes, I need to keep track of what I do when, and to do this I use an Excel worksheet with three columns labeled Date, Activity, and Hours. I would like to display the total number of hours spent on each activity for a given range of dates. My approach has been to create separate columns for each activity. In these columns I've used the IF function to copy the number of hours per activity. For example, in D2 (see Figure 1) I have the formula

```
=IF($B2="A",$C2,"")
```

If B2 is "A", D2 gets the value of C2. Otherwise, it gets a NULL string.

Then, using a combination of SUM, INDEX, and MATCH, I've created a table that tallies the number of hours per activity per time period. For example, in K8, the first cell of this table, I have

```
=SUM(INDEX($A$2:$H$23,MATCH
(K6,$A$2:$A$23,1),4):INDEX
($A$2:$H$23,MATCH(K7,$A$3:
$A$23,1),4))
```

It works, but surely there must be a slicker way.

Bob Harvey
via the Internet

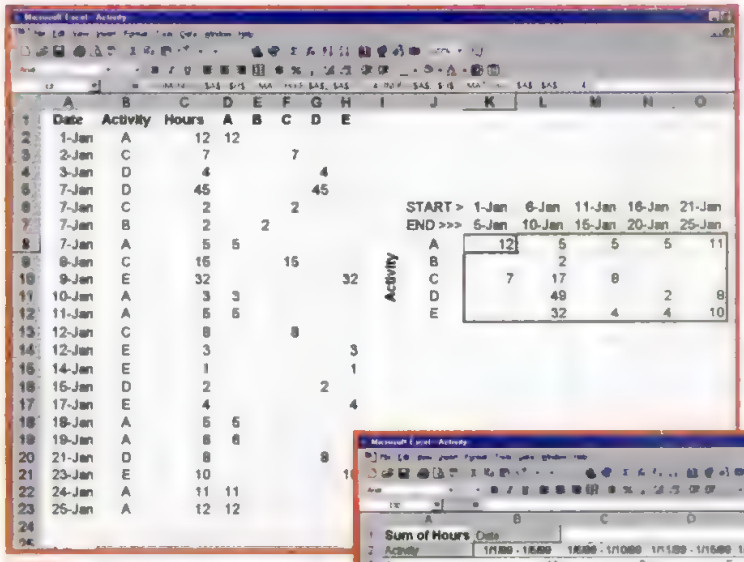
PC Actually, if you're going to use formulas to do your cross tabulation, this method may be as good as any other. You could experiment with DSUM to see if that relieves your pain. But with DSUM, you'd have to create criteria ranges for each combination of time period and activity, which is a fairly severe nuisance. Your formulas are complex, but you've set up your absolute and relative references in such a way that you can create a single IF formula and a single SUM formula and then just replicate them into adjacent cells.

There is a slicker method, though, and it doesn't require you to create any formulas. Use Excel's pivot table feature. Figure 2 shows the pivot-table equivalent of cells K2:O12 in Figure 1. To generate this table, start by selecting the original database—cells A1:C23. Choose *PivotTable Report* from Excel's *Data* menu and specify Microsoft Excel list or database as your data source. Click *Next* until you come to the PivotTable Wizard's third screen, which asks you to specify the layout of your table. Drag the *Date* button to the Column area, the *Activity* button to the Row area, and the *Hours* button to the Data area of the layout diagram. Click *Finish* and you've got your table.

Initially, your pivot table will show a separate column for each date in your table. You want the columns to show five-day periods instead, so click the *Date* heading on the finished table, and then click the *Group* tool on the PivotTable toolbar. In the *Grouping* dialog box, select *Days* and deselect all other time periods. Then, enter 5 in the *Number of Days* control at the bottom of the dialog box. Click *OK*, format to taste, and you're done.

To maintain the table as your database grows, select any cell in the table, click the *PivotTable* button on the PivotTable toolbar, and choose the *Wizard* command. When the wizard appears, click *Back* to get to Step 2. Then, simply adjust the source range of the table to accommodate your new data.

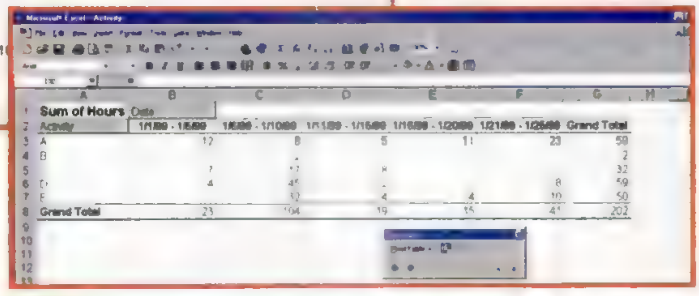
If you change the contents of any cell in your source database, remember that Excel doesn't refresh pivot tables automatically. To keep the table in sync with modified data, click the big red exclamation point on the PivotTable toolbar.—*Craig Stinson*



Date	Activity	Hours	A	B	C	D	E
1-Jan	A	12	12				
2-Jan	C	7			7		
3-Jan	D	4				4	
7-Jan	D	45				45	
7-Jan	C	2			2		
7-Jan	B	2		2			
7-Jan	A	5	5				
8-Jan	C	16			16		
9-Jan	E	32					32
10-Jan	A	3	3				
11-Jan	A	5	5				
12-Jan	C	8			8		
12-Jan	E	3					3
14-Jan	E	1					1
15-Jan	D	2				2	
17-Jan	E	4					4
18-Jan	A	5	5				
19-Jan	A	8	8				
21-Jan	D	8				8	
23-Jan	E	10					10
24-Jan	A	11	11				
25-Jan	A	12	12				

Activity	START > 1-Jan	6-Jan	11-Jan	16-Jan	21-Jan
END >>>	5-Jan	10-Jan	15-Jan	20-Jan	25-Jan
A	12	5	5	5	11
B		2			
C	7	17	8		
D		49		2	8
E		32	4	4	10

FIGURE 1: *You can use separate columns to keep track of what you do when, and you can create formulas to tally the results.*



Sum of Hours	Date					
Activity	1/1/99 - 1/5/99	1/6/99 - 1/10/99	1/11/99 - 1/15/99	1/16/99 - 1/20/99	1/21/99 - 1/25/99	Grand Total
A	12	8	5	11	23	59
B		2				2
C	7	17	8			32
D	4	49		2	8	59
E		32	4	4	10	50
Grand Total	23	108	17	17	41	202

FIGURE 2: *Or you can use Excel's pivot table feature and you won't have to worry about formulas at all.*

No Sound from the Speaker

I am unable to listen to audio CDs through the speakers on my new computer system; I can listen only with headphones plugged into the jack on the CD drive. How can I solve this problem?

Derek VanBuskirk
via the Internet

PC There are two prime suspects for this problem, one software and one hardware. The software you can check without opening the case, so that's definitely the one to check first.

Double-click on the speaker icon in the Tool Tray on your Windows status bar at the

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bottom of the screen and check to make sure that the CD audio channel in the sound mixer is not muted and that the volume level is set at least halfway up.

If this does not resolve the problem, then the next most likely problem is that the CD-ROM drive is not connected to the sound card inside the computer. CD-ROM drives have three connections: one for power, one for data (a ribbon cable), and one for stereo sound (typically a thin, round cable).

The CD-ROM drive can read CD-ROM disks and translate the data into the digital information sent to the controller just as if it were coming from a hard disk. For CD-audio disks, however, the drive interprets the data and converts it to analog signals. This is why you can hear the sound through headphones plugged into the front jack on the drive; headphones are analog devices.

In order to get sound from the CD drive to the computer speakers, the sound card must receive the signal. The stereo cable from the drive to the sound card is designed to do this inside the computer case. If your drive does not have the cable installed, contact the maker of your system and see if it can provide one. If not, you may be able to get one from a company that specializes in computer cables, but be prepared to provide the make and model of your sound card and CD-ROM drive, because not all use the same connectors.

If you can't get a cable that works or if you're waiting for one to arrive, there is another possible workaround. If your sound card has a Line Input jack, you can run a cable from the headphone jack on the front of the CD-ROM drive to the Line Input jack on the sound card, thus routing the sound through the card and out to the speakers.—*Alfred Poor*

Add Old Programs to the Start Menu

In Win 3.1, it was easy to add an application to a program group or to create a new group, and I could run any program merely by specifying the correct path and command-line information. I'd like to know how to do the same in Windows 95. It doesn't seem to be straightforward anymore.

I just installed a new hard disk, and with a fresh installation of Windows 95, I'm trying to add back some of the stuff from my backup tape. I want to add Cardfile.exe and its related files to Accessories\System Tools. I'd also like to add other executables to various folders. Windows 95 lets you install software, but it wants an install floppy disk or CD. The help files

don't address how you do it when you have only an executable file like Cardfile.exe. Can you help?

Leo Palmer
via the Internet

PC Most modern programs come with install utilities that copy necessary files to the hard disk, set up menu shortcuts, and possibly add essential information to the Registry. You can attempt to install such a program by copying the files manually and creating the shortcuts as explained below. Unfortunately, there's no easy way to initialize that Registry information by hand. If a program totally depends on having Registry data initialized by its install program, you'll just have to reinstall from disk or CD-ROM.

Many older programs, however, don't use the Registry and don't come with an install utility. Even modern programs may avoid this requirement if they're small, single-function utility programs. In that case, you simply copy the necessary files to your hard disk and create a shortcut in the Start menu. Let's take your specific example of adding Cardfile.exe to the Accessories\System Tools menu. Just follow these steps:

Right-click the *Start* button and choose *Explore*. Now, open the Programs folder (which directly corresponds to the Programs menu), then the Accessories folder within Programs, and then the System Tools folder within Accessories. Right-click on an empty area in the right-hand pane and choose New from the pop-up menu. Choose *Shortcut* from the submenu, click on the *Browse* button, and locate Cardfile.exe. Click on *Next*, enter the name you want displayed in the menu, and click on *Finish*. This creates the desired menu item. Note that you do *not* put Cardfile.exe and its ancillary files into the folder that defines the menu. Rather, you insert a shortcut to the file. The file itself can reside anywhere on your system. To add a new menu folder, follow the same procedure but choose *Folder* from the *New* menu rather than *Shortcut* and give the new folder whichever name you please.—*Neil J. Rubenking*

Calendars in Word 97

Is there a way to create a monthly calendar in Microsoft Word 97 that will place each day in its own box, so you can enter information for each day—such as a to-do list or special events? I tried using the Calendar Wizard that I still have left over from Word 7, but the Wizard simply inserts the days with no boxes around them.

Angella Van Oevelen
via the Internet

PC You can get the effect you want either by starting from scratch or by starting with the calendar that the Word 7 Calendar Wizard generates. Office 97 comes with a Calendar Wizard of its own, however, which will make the task much easier. The Wizard is easy to overlook, because Office doesn't install it as part of the setup routine. You'll find it on the Office CD in the Valupack\Template\Word directory.

To make the Calendar Wizard available to Word, find the Templates directory in the Office 97 directory on your hard disk, and copy Calendar.wiz from the CD to the Templates directory or one of its subdirectories. For purposes of this discussion, I'll assume you put it in the Other Documents subdirectory. If you're not sure where the Templates directory is, choose *Options* from the *Tools* menu, click the *File locations* tab, and find *User Templates* in the list.

To use the Wizard, choose *File | New*, then *Other Documents*, and choose Calendar.wiz as the template to use. Choose *OK* and Word will open a new blank document and run the wizard. You'll have the choice of three styles

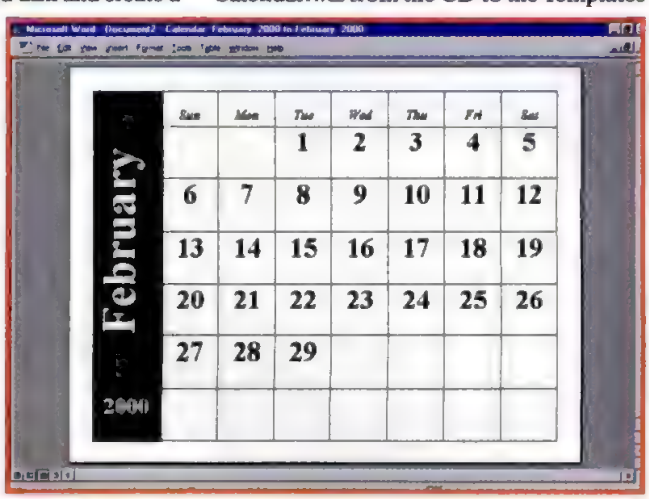

FIGURE 3: *Office 97's Calendar Wizard creates calendars with borders around each day, and you can add text to each if you want.*

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for the calendar, whether to use portrait or landscape mode, whether to leave room for a picture, and what month or months to create calendars for. (You can create a calendar for any month in any year from 1900 to 4095.) Make your choices, choose Finish, and the Wizard will create the calendar, as shown in Figure 3.

The Word 97 Calendar Wizard uses a table to create the calendar. It inserts each day's number into its own cell and uses borders to create boxes around each day. Each number takes up roughly the top half of the box, leaving relatively little room to write notes. But if you move to one of the cells, move the cursor past the number, and hit Enter, you'll find that the next paragraph automatically switches format so that it's left aligned, 10-point text, and unbolded, rather than using the number format of centered, 42-point, and bold. With the format the Wizard provides, you have room to type two lines of text for each day. If you need more, the row will grow in height, but at the expense of pushing the bottom row further down the page. And because the table is inserted in an autoshape—which works much the way a text box does—the bottom row won't spill over to the next page as you expand row heights. Rather, it simply won't print. This may be acceptable in a month limited to five rows, as in the figure. In a month that spills over to a sixth row, however, you'll lose the last days in the month.

Fortunately, if you need more room for writing notes for each day, it's easy to get. You need only change the numbers for the days to a smaller font size. You can do this at any time, without affecting any other text in the calendar, by redefining the font size for the style.

The Calendar Wizard puts styles to good use by defining each kind of text in the document as a different style. These names change depending on which calendar you chose (Jazzy, Banner, or Boxes).

To change the font size for any of these styles, first confirm the style name by moving your cursor to an appropriate paragraph and noting the name that shows in the *Style* text box on the Formatting toolbar. Then choose *Format* | *Style*, select the style name on the *Styles* list, choose *Modify*, then *Format* | *Font*. Pick the new point size to use, choose *OK*, then *OK* again, then *Close*. Word will change the size of the numbers to match the modified definition and leave you with more space in each box to write notes. Change the font size for the numbers to 12 points, for example, and you'll have room for 5 lines of text without changing the row height for the cell.—*M. David Stone*

Fix an Access Glitch

I'm using Microsoft Access 97 SR-2, and I have a bound combo box on a form. The underlying field has its `Required` property set to `True`. But I've found that the user can delete the combo box text and press Esc—and by so doing, leave a Null in the field on the form. What am I doing wrong?

Peter Bucknell
Melbourne, Australia

PC It's not you, it's a glitch in Microsoft Access 97. Access should be restoring the value of the combo box to its original value when the user presses Esc. Because of this glitch, however, your combo box's value is being set to a Null string. The Null string won't be saved though, because when Access tries to update the record the update will fail. So the damage is limited to some potential user confusion regarding the user interface.

You can reproduce this problem with the Northwind sample database (see Figure 4). Open the Orders form and notice the *Bill To* combo box that is bound to Customer ID. The text in mine says "Alfreds Futterkiste" after I open the form. Now, highlight the value in the combo box and delete it. Next, press Tab. You'll see an error message. Press *OK* to close the error message and you'll end up back in the combo box. Now press Esc. At this point, your combo box should be restored to "Alfreds Futterkiste," but instead, it has no value and you can freely tab out of the control.

Normally, Access won't let you leave a Null string in a bound combo box if the underlying field has the `Required` property set to `True`. The expected behavior is that you'd see an error message immediately after you leave the combo box. In this instance, however, because of the glitch, Access won't trap the error and give the usual error message. But you also won't be able to save the record unless you go back and enter something in the combo box, since the underlying field is `Required`.

I spoke to a program manager at Microsoft about this and the problem is fixed in the current Access 2000 beta. In the meantime, he suggested you consider placing code like the following in the `BeforeUpdate` event attached to the combo box:

```
Dim strMsg As String, strTitle As
String
Dim intStyle As Integer
If IsNull(Me!CustomerID) Or
Me!CustomerID="" Then
 StrMsg = "You must pick a value from
the Bill To list."
 StrTitle = "Bill To Customer
Required"
 IntStyle = vbOkOnly
 MsgBox strMsg, intStyle, strTitle
 Cancel = True
 Me.Undo
End If
```

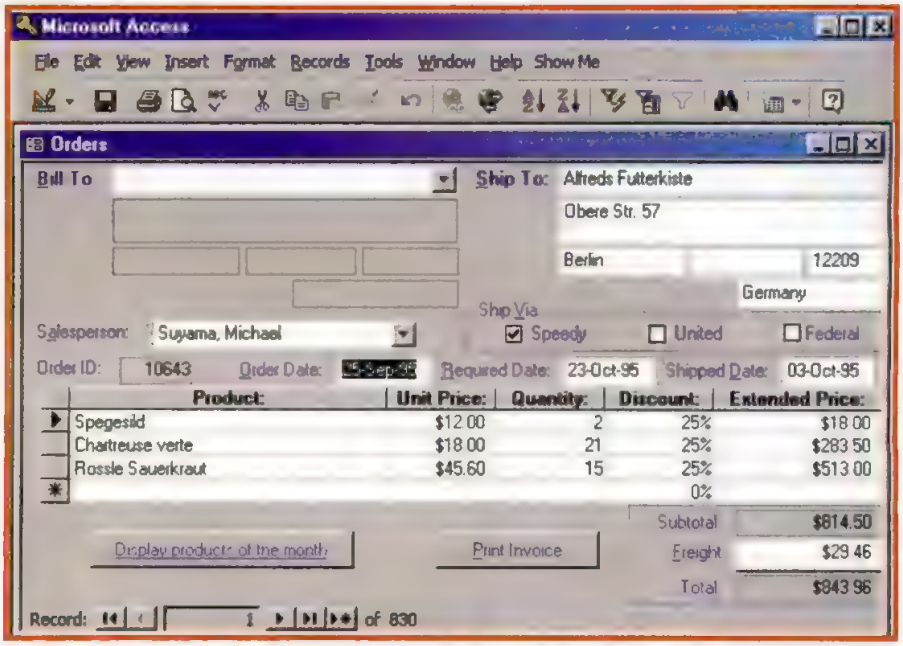
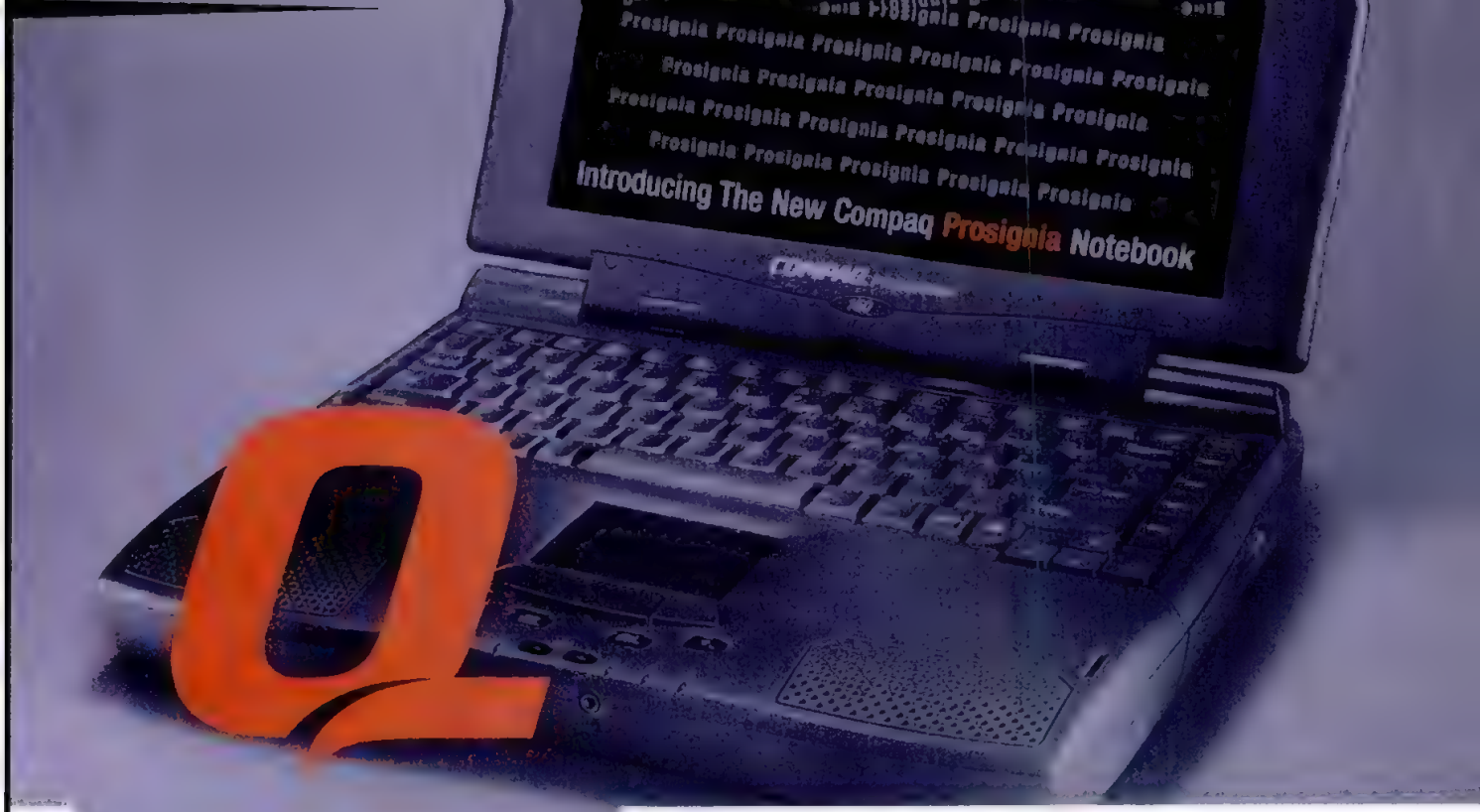


FIGURE 4: *Pressing the Esc key erroneously lets you leave a combo box in a Microsoft Access form blank.*



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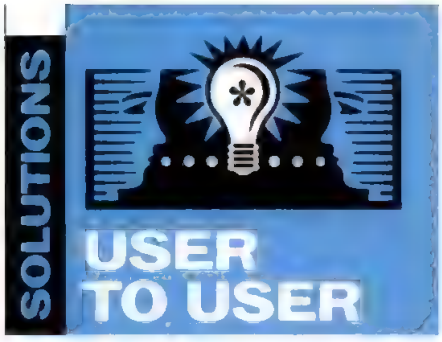
The `Me.Undo` line in this code undoes any changes you made to the form, including the Null value in the combo box. Because the `Undo` undoes changes to every field on the form, though, it's not an ideal solution. What's really needed is a way to solve the *real* problem (in addition to the glitch).

The real problem is that there's currently no universal way to insist that an entry is required in a combo box that works in all situations. For instance, an unbound combo box has no underlying field and thus cannot rely on an underlying field's `Required` property. You can place code in the `BeforeUpdate` event, but the event is triggered only when changes are made. If no change is made, the event is not called.

I've suggested the obvious to Microsoft—that they add a `Required` property to the combo box itself. I'm told this suggestion is under consideration. In the meantime, you'll have to rely on the form and control level `BeforeUpdate` events—and for bound combo boxes, the underlying field's `Required` property.—*Sal Ricciardi*



Scripting the Start-Up Menu

The System Configuration Utility is a handy addition to Windows 98. One of its most useful features is accessed through its *Startup* tab (see Figure 5), which provides a convenient interface for choosing which programs will run during start-up (including those that are launched from the registry). If all you want to do is prevent the items in your StartUp folder from running, however, this interface can become a bit tedious. You have to uncheck all the little boxes next to the StartUp folder items, while taking care not to uncheck any of the registry items.

Of course, there's always the good old Shift key. You can suppress the start-up programs by holding it down while your system starts, but I always either press it too late, let it up too quick, or press the Ctrl key by mistake.

My solution was to write a Windows Scripting Host (WSH) script that lets me accomplish the desired result with just two mouse clicks. Written in VBScript, the script checks to see whether there are any files in my StartUp folder. If there are, the script asks me whether I want to deactivate my StartUp folder. If I click the *Yes* button, the script moves all of the files from my StartUp folder to a temporary holding folder located in the root directory.

If the script doesn't find any files in my StartUp folder, it assumes the files are in my temporary folder, and it asks whether I want to activate my StartUp folder by moving the files back.

Robert Perry
via the Internet

PC As we've mentioned before, WSH scripts written in VBScript or JavaScript are the modern equivalent of DOS batch files. If you ever wrote a batch file to simplify your work or automate a repetitive task, you should consider learning to write scripts for the WSH. With that goal in mind, we'll go over this script in detail. Its use of subroutines makes it particularly easy to follow. You can access the script at our Web site if you want to follow along.

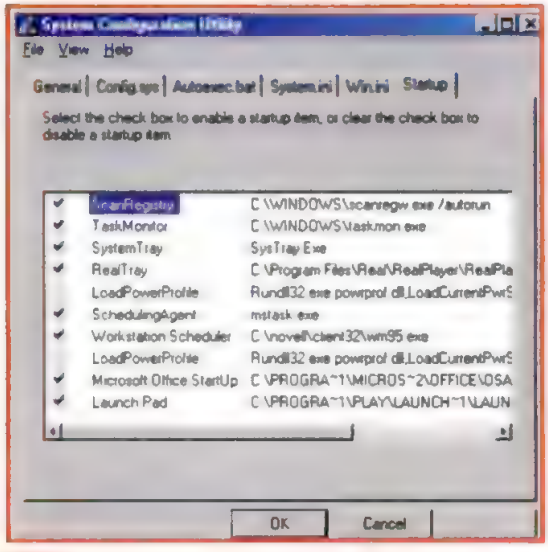


FIGURE 5: *The System Configuration Utility is one way to choose which programs will run during start-up.*

The author originally hard-coded the location of the StartUp folder as "C:\Windows\Start Menu\Programs\StartUp," but it's not safe to assume that will be correct on every system. The Windows folder need not be C:\Windows, and even when it is, if user profiles are enabled the actual location will be something like C:\Windows\Profiles\Neil\Start Menu\Programs\StartUp. I've modified the script so it uses the `Shell` object's `SpecialFolder` method to get the actual location of the StartUp folder. This method can retrieve a number of other special folder locations, including the Desktop, Start Menu, Favorites, Fonts, and Recent Documents folders.

After initializing the `SU` variable with the location of the StartUp folder, the script creates a `FileSystemObject` variable named `FSO`. Note that this object is used in several of the subroutines; VBScript variables are global in scope. If the StartUp folder is empty and the holding folder is *not* empty, the script calls the `Activate` subroutine. If both are empty there's nothing to do, and it reports this fact using the VBScript function `MsgBox`. (Note that the `MsgBox` statement is split across three lines; the underscore at the end of the first two lines is VBScript's line-continuation character.) If the StartUp folder is not empty, it calls the `Deactivate` subroutine.

To determine whether a folder is empty, the script uses a subroutine called `FolderSize`. This subroutine returns the number of bytes occupied by a folder's contents; if it returns 0, the folder is empty or nonexistent. It calls on the `FileSystemObject` variable's `FolderExists` method to determine whether the folder exists. If so, it calls on the `FileSystemObject`'s `GetFolder` method to create a `Folder` object associated with the folder on-disk. The `Folder` object's `Size` property represents the size of all files and folders within this folder.

The `Activate` subroutine uses the `MsgBox` function to ask the user whether or not to activate the StartUp menu. On a yes answer, it calls the `Relocate` subroutine to move all files from the holding folder to the StartUp folder. The `Deactivate` subroutine also queries the user. Before calling `Relocate`, it creates the holding folder if necessary.

To move all files from one folder to another, the `Relocate` subroutine creates a `Folder` object associated with the source folder and sets the variable `TheFiles` to the `Folder` object's `Files` collection. This collection contains a `File` object associated with each file in the folder. Then the script loops through all elements of the collection, copying each to the destination folder and deleting the original. To do so, it uses the handy `For Each...Next` statement. This statement iterates through the elements of a collection or array, assigning each element in turn to a variable.

As you can see, the `FileSystemObject` object, `Files` collection, `Folder` object, and `File` object provide a complete set of services for scripts that need to query or manipulate files and folders. For more information on VBScript and the Windows Scripting Host, visit Microsoft's Web site at *http://msdn.microsoft.com/scripting/windowshost.*—*Neil J. Rubenking*

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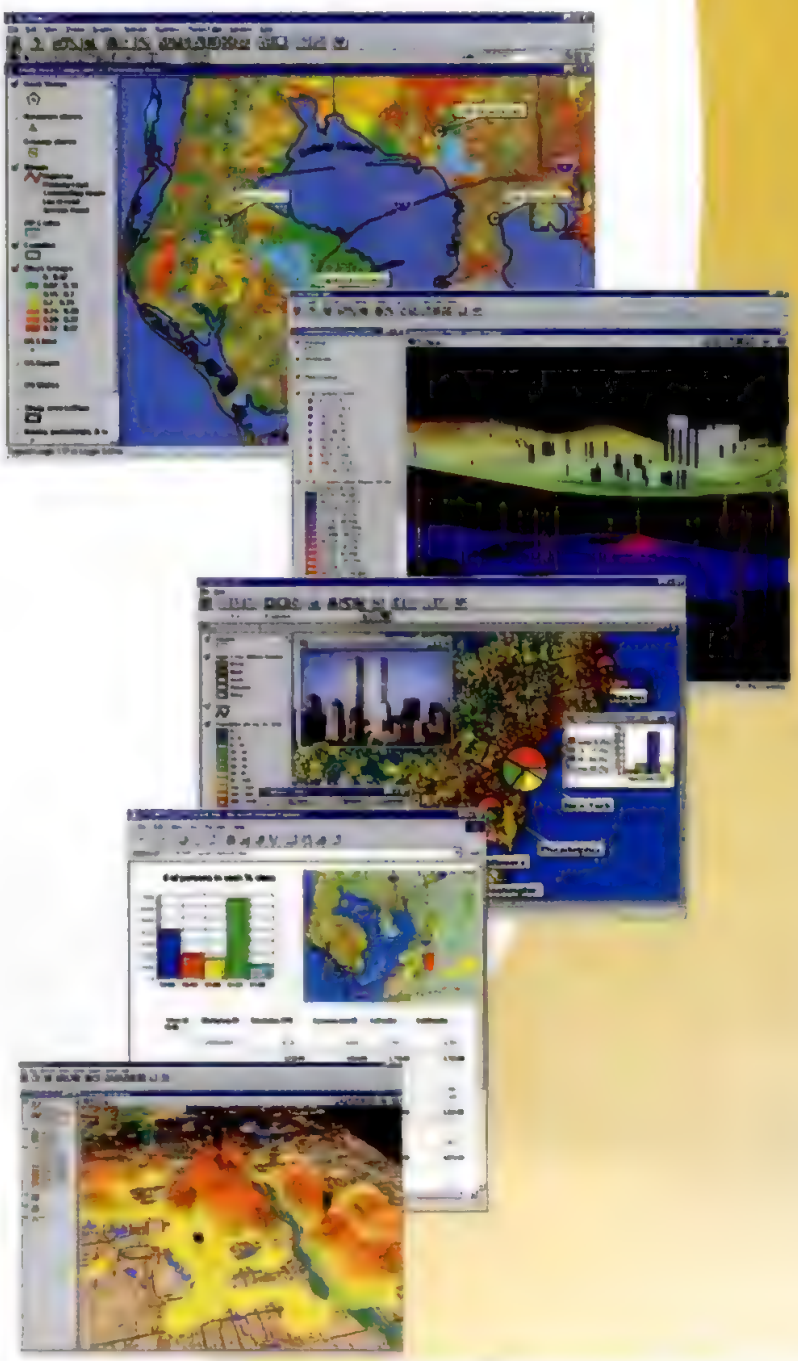

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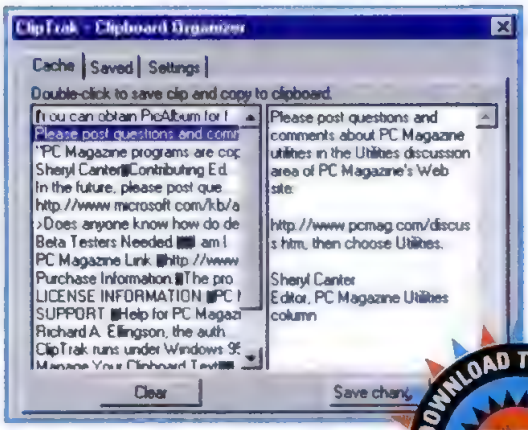
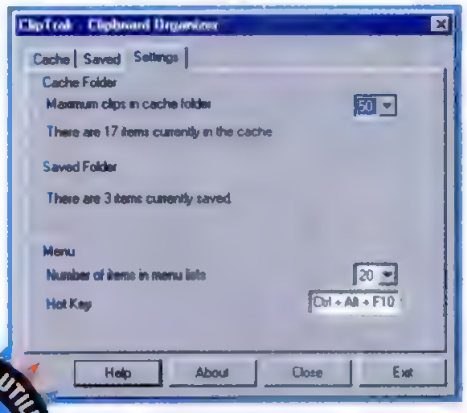
ClipTrak runs under Windows 95, 98, and NT 4.0. An article about how to use ClipTrak and how it was written is available on our Web site at *www.pcmag.com/utilities*. A link to download the utility and source code can also be found there.

Richard A. Ellingson, the author of ClipTrak, is a sysop for ZDU on the Internet. Sheryl Canter is the editor of the Utilities column and a contributing editor of PC Magazine.

The Cache is a list of your most recent clips. When you highlight a clip in the list on the left, the full text of the clip is displayed on the right. Double-clicking a clip saves and copies it to the Clipboard.





The Settings page is where you set the Cache size, the number of clips in the menu lists, and the program hotkey. The hotkey displays a pop-up menu for accessing your list of clips at the current cursor location.

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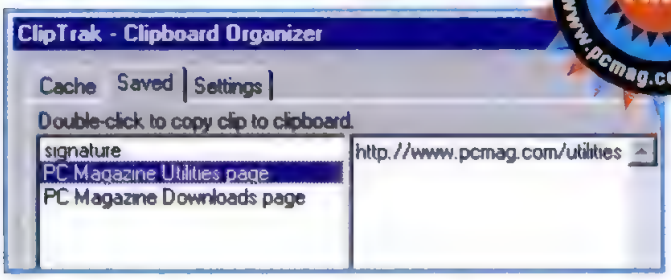
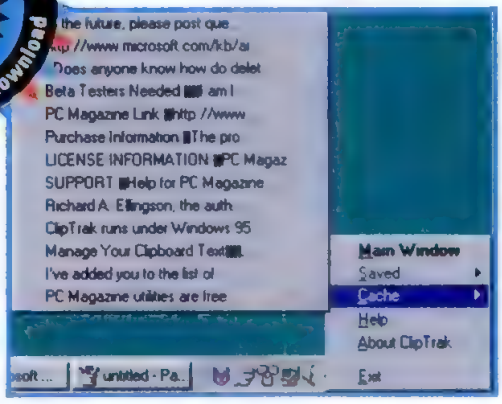


The Saved list contains only those clips you've chosen to save from the Cache. You can rename Saved clips or delete them, and you can edit the text of the clip in the right-hand pane. Double-clicking a Saved clip copies it to the Clipboard.



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PC MAGAZINE
SPECIAL REPORT

Plug Your Company's Common Security Holes

By Nate Lawson and John Garris

Every day, we read about the relative insecurity of the Internet, revealed by numerous reports of vulnerability and attacks. Is this all hype, or is there substance behind the headlines? One optimistic view claims that by deploying a sound combination of firewalls and other security technologies, companies can use the Internet with complete safety.

In fact, this belief can be very misleading. In most cases, simply deploying technology isn't enough to ensure secure systems properly. In this article, we outline two scenarios illustrating security holes that can develop despite well-intentioned attempts to utilize security technologies. At the end of the article, we discuss an approach to preventing unexpected security holes and building effective security practices.

SPOOFING THE DNS SERVER

Let's consider a fictitious discount computer reseller called MicroEmporium. This company generates a lot of sales leads through its Web site (*www.microemporium.com*), but to save maintenance costs, it outsources this service. The IT team has done a good job of securing its Web server by installing security patches and enforcing the use of good passwords for system access.

But one day at the height of a much-advertised spring sale, customers go to the site yet don't see computers for sale. Instead, they find a completely different set of pages mocking MicroEmporium's business practices. After some hours of testing and analysis, the IT team realizes that MicroEmporium's customers are being redirected to a totally different site owned by a malevolent attacker. The culprit in this attack is a corrupted Domain Name System (DNS) entry at MicroEmporium's authoritative DNS server.

In this scenario, the attack can take place because the DNS implementation has not been secured against caching a fraudulent entry. When a requester (such as a Web browser) needs a DNS name to be resolved to an IP address, a local DNS server scans the Internet to locate the authoritative DNS server for that domain. It then asks that server to resolve the name. The authoritative server replies to the local DNS server, which then forwards the answer to the requester. The answer is also cached at the requesting server for future reference.

The diagram "How Hackers Can Corrupt Your DNS" shows how an attacker can exploit this process by corrupting the cache of an authoritative DNS server. First, he modifies the record of a domain that he owns (such as attacker.com) to add an additional entry mapping the MicroEmporium site to an IP address the attacker owns.

Second, the attacker queries MicroEmporium's DNS server to resolve *www.attacker.com*. To service the request, that server will query the attacker's DNS server and receive a record containing not only *www.attacker.com*'s IP address but also the IP address the attacker chose for MicroEmporium.

If the DNS server was properly configured to reject secondhand information, it will simply disregard all server entries that aren't part of the attacker.com domain. But in this case, it stores the corrupted entry in its DNS cache. As a result, subsequent client requests to resolve the microemporium.com domain name will direct users to the attacker's Web site rather than the original site.

This problem is widely understood in the security community, but despite that, a significant percentage of servers is subject to this vulnerability. CERT has published an advisory describing the details of this attack at *ftp://info.cert.org/pub/cert_advisories/CA-97.22.bind*. In July 1997, Eugene Kashpureff at AlterNIC used the vulnerabilities in DNS to redirect users from *www.internic.net/*to AlterNIC's site in a protest against InterNIC's claim of ownership over the Internet's high-level domains.

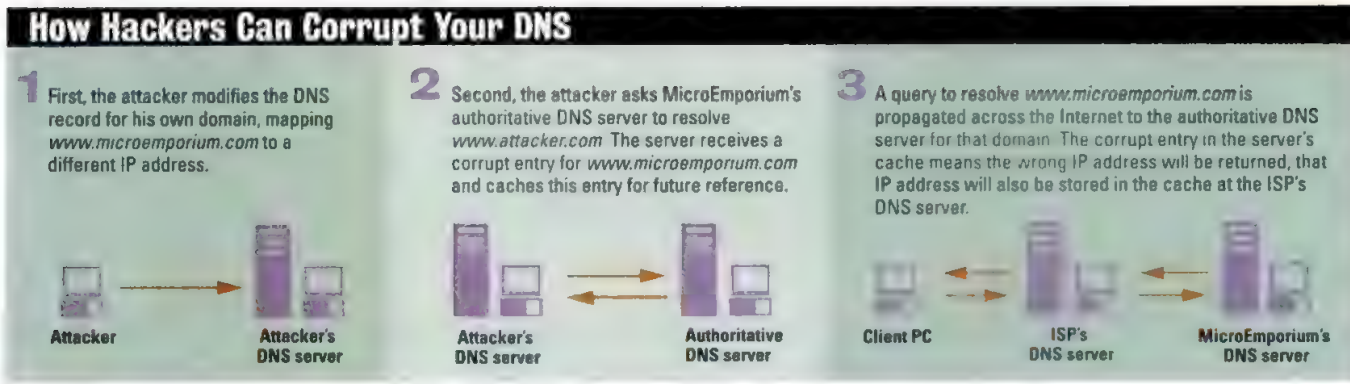
FIXING THE PROBLEM

Despite the IT team's attempts to secure Web server software, the site was still compromised through infrastructure not managed by the MicroEmporium team.

There is no comprehensive fix to address all the DNS servers on the Internet, but there are steps the team can take to reduce risk of attack. The simplest solution would be to bring security expertise in-house and review security procedures at the provider. A more stable solution would be to bring its systems and DNS services in-house and have its dedicated security team keep them up to date with security patches.

The team could also use Secure Sockets Layer (SSL) and digital certificates for sensitive portions of the site. If they did so, careful users going to the redirected site would find that the server's digital certificate doesn't match the intended destination. Unfortunately, this isn't a foolproof solution as many users pay little attention to certificates they receive while surfing.

How Hackers Can Corrupt Your DNS



DIAL-UP ACCESS IS THE ACHILLES' HEEL

Our second scenario describes a common situation that appears safe but which in reality exposes a pathway into a company's internal network. In this case, the same fictitious company, MicroEmporium, invests heavily in firewall and remote-access security, but it overlooks users dialing out to the Internet from their desktop PCs.

Most network administrators understand the problems associated with letting users set up their own remote-access links. Using Windows NT RAS or pcAnywhere, for example, employees can inadvertently open security holes by allowing any dial-up user access to the company network.

But as the diagram "How Dial-Up Access Can Expose Your LAN" illustrates, a user can open security holes simply by establishing an outbound Internet connection, even if his modem isn't configured for dial-in access.

In this scenario, a MicroEmporium employee uses a dial-up Internet account to chat with friends. Although corporate mail is accessible through the LAN, he still frequently dials in to his existing account to access Internet applications that are blocked by the corporate firewall.

The problem here is that while a user is dialed into the Internet and simultaneously connected to the corporate LAN, his machine is a potential gateway between the two networks. For an attacker to exploit this possibility, he must enable *proxy functionality* on that user's machine (by installing a program that will let him remotely control that machine), wait for the user to connect to the Internet, and then use that machine as an intermediary to access the corporate LAN.

The first step is the most difficult and is more likely to succeed if the attacker doesn't target a specific user. Here, the hacker sends a Trojan horse, disguised as an amusing e-mail attachment, to the company-wide e-mail list. Anyone who opens that attachment unwittingly installs a notorious program called Back Orifice on his machine. Back Orifice lets an intruder control a PC by sending it commands over the network.

The attacker could also use other less common methods to distribute the executable. These methods include obtaining physical access to a user's PC or circulating a virus or worm with the goal of installing code on as many machines as possible. The code could then notify its home base each time a machine is compromised, letting the attacker choose its targets at a later time.

After the program is installed, the attacker simply waits for the company's users to dial up their Internet providers. If any user's machine has been subverted by the Trojan horse, it will automatically send an e-mail to the attacker, informing him of the computer's current IP address.

Once an infected user dials into the Internet, the attacker has an open channel into the company's LAN and can browse or modify files on the network via Back Orifice, just as if he were seated at the victim's PC. Note that a single modem user installing the Trojan horse compromises the entire network; instead of targeting one user, the attacker targets many and simply focuses on the first one that falls prey to attack.

FIXING THE PROBLEM

There are two issues MicroEmporium must address to rectify this security exposure. First, the IT staff needs to educate users about bringing unknown content into the network environment. Any executable, even one that passes a virus scan, may subtly modify users' machines. As an additional precautionary step, MicroEmporium might install software that removes potentially dangerous e-mail attachments.

Second, all network access should be limited to channels that are managed by the corporate security team. By limiting network connections to the firewall and authorized remote access, it will be easier for the MicroEmporium IT team to manage access to the corporate network. The unfortunate consequence of this approach is a less friendly environment in which users are restricted from certain potentially dangerous applications. But if security is essential to your organization, this is a policy you'll need to implement.

TAKE A TOP-DOWN APPROACH TO SECURITY

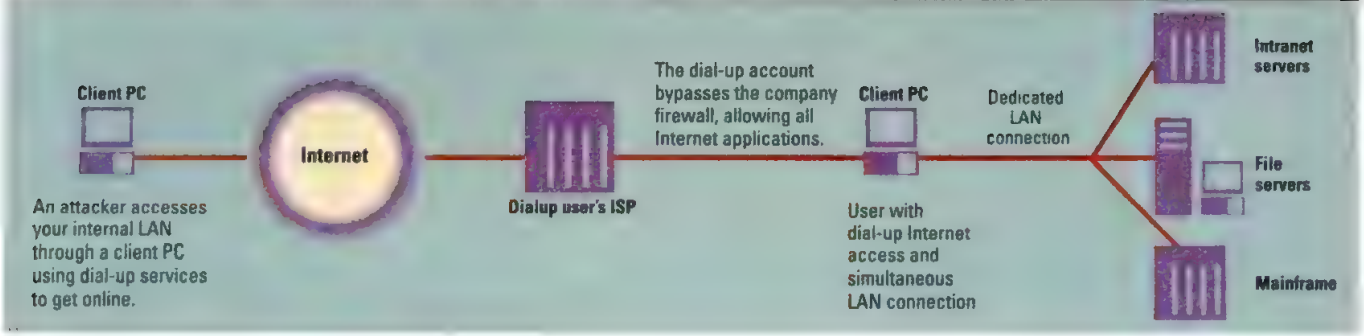
In both of these scenarios, the proper solution is to consider the system as a whole from the start, before actually designing and implementing security features. Technology fixes, such as securing Web servers and configuring firewalls, are one part of the answer, but building effective security mechanisms requires a top-down approach.

The intrusion methods described here require some level of sophistication and persistence on the part of the attacker, but they are quite possible to undertake in the real world. To a business, the fact that such attacks may be difficult to implement should be weighed against the financial value of information potentially exposed as a result of an attack. This process is a fundamental part of designing a security policy and requires more than a technology-focused approach.

A holistic approach to system security should be a way of life for anyone concerned with preventing unauthorized access. By avoiding the temptation to focus on individual technologies and access points and examining the system as a whole, companies can identify many previously undiscovered risks and build a more secure IT environment. PC

Nate Lawson and John Garris are leaders at Scient, an eBusiness Systems Innovation firm. *The authors thank Brandon Eisenmann for helpful discussions and Bob Keyes for his continuing work with DNS problems.*

How Dial-Up Access Can Expose Your LAN



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Microsoft Office 2000 Developer

By Will Fastie

At the top of the Microsoft Office 2000 product family sits Microsoft Office 2000 Developer (MOD), Microsoft's collection of tools for building and deploying custom Office applications. MOD is the successor to Microsoft Office 97 Developer Edition (ODE), reviewed in our August 1997 issue. Much of that earlier article focused on Visual Basic for Applications (VBA), which at the time was just finding its way into the market. ODE itself we found somewhat wanting.

Despite the complexity of adding VBA to a product, many applications now incorporate it. Perhaps the most stunning announcement was that Corel would add VBA alongside the company's own powerful but proprietary macro language. From AutoCAD to Visio and now WordPerfect, VBA provides the glue that allows these programs to become components for your custom application. It's a powerful concept.

But as we noted last time, you did not need ODE to use VBA. VBA is built into the Office programs at every level so, for example, you can write Visual Basic code to build an application out of Microsoft Word and Excel. And that's still true—you don't need MOD to write VBA programs for Office, or for that matter, any other product incorporating VBA. So the question we asked two years ago—whether ODE brought anything to the VBA party—is pertinent today. The answer last time was no, with a single but important exception: ODE included the Microsoft Access runtime license, a requirement if you wanted to distribute an Access application to a computer without Access. What we hoped to find today was more value in the MOD box. We're happy to report that Microsoft obliged.

For this review we looked at Microsoft Office 2000 Developer Beta Release 2. As we examine the product, we'll use the old ODE review as a starting point. That's the easiest way to see how the product has improved.

WHAT YOU GET

The MOD box holds two major components: a full copy of Microsoft Office Premium and the MOD tools CDs. Premium adds FrontPage 2000 and PhotoDraw 2000, which were not part of Office 97 Professional Edition, to the Office lineup. The MOD tools comprise four CDs, one for the tools themselves and three for the MSDN Library. The same MSDN Library CDs come with all Microsoft's tools products; now MOD has parity with the other developer tools. We like having ready access to all that information and feel it's especially important for Office developers.

The MOD tools include the following components:

- *Access 2000 runtimes.* Like ODE, MOD provides the files and the royalty-free runtime license that lets developers deploy Access applications on systems that don't have Access installed. For what must be a dwindling group of developers still using Access 95, ODE and MOD replace the old Access Developers Toolkit (ADT). The Access runtime license was a reason to buy ODE. For MOD, it's much less important.
- *Package and Deployment Wizard.* The only good thing we can say about Microsoft Setup Wizard, ODE's tool for creating an installation program to deploy VBA apps, is that it is cheap. The fact that the tool ran exclusively within Access contributed to our sense that ODE was little more than a reworked Access Developers Toolkit.

MOD's Package and Deployment Wizard is a dramatically better tool, and very simple (see Figure 1). First and foremost, it runs within any VBA host, not just Access, because it's one of the MOD *add-ins* (we'll discuss add-ins below). Though we'd prefer a standalone program, the tight connection with the program development environment gives the Wizard the handle it needs to "see" all the components that must be included in a deployment package. Unlike the ODE Setup Wizard, which we recommended only for casual use, the Package and Deployment Wizard can be used for all but the most demanding packaging. MOD thus frees developers of the need to acquire expensive installation tools: a significant value.

- *Replication Manager.* Replicas are copies of a database and they must stay synchronized with one another. For example, a mobile user might want to have a laptop copy of a sales database while on calls and then upload changes to the master database on a server. Replication Manager facilitates the configuration of those databases and the synchronization strategy they use. The most significant change from ODE is an update to support Jet 4.0, the new version of the Jet database engine.
- *Source code control tools.* ODE's ability to participate in source code control (configuration management) was very limited. We complained about the need to purchase extra components and suggested that Microsoft Visual SourceSafe be included in the product. Happily, that's exactly what happened. Visual SourceSafe 6.0 is now included on the MOD tools CD. This is a huge improvement and essential for the kind of team development likely in corporate settings.

ILLUSTRATION BY JEAN TUTTLE

• *ActiveX controls.* We objected to the fact that a suite of ActiveX components that we thought should have been included along with VBA (that is, with Office 97 itself) was instead provided in ODE, an extra-cost option. Unfortunately, this hasn't changed. MOD's larger and more interesting set of ActiveX controls is not included with the Office 2000 suite. Our complaint is based on the notion that VBA is just a slightly different version of VB, so it's reasonable to expect VBA to have the same general capabilities as VB. Excluding controls seems to diminish VBA.

The greatest value in the expanded set of controls is in those for database access, including the ADO Data Control, DBCombo, DataList, DataGrid, DataCombo, and MSFlexGrid. If data access is a necessary part of your VBA applications, this collection is essential. Keep in mind, though, that if you own VB6 you already have all the ActiveX controls that come with MOD.

• *Printed documentation.* The documentation provided with ODE was less than satisfactory. Access 97 developers may have been happy with the "Building Applications with Microsoft Access 97" manual, but it shed little light on ODE. It is not included with MOD. Instead, some of its content appears in the new "Microsoft Office 2000 Visual Basic Programmer's Guide," an update of the ODE 97 book. Actually, calling the new Guide an update is wrong. The new Guide is a complete rewrite, and dramatically better.

The Guide is not a reference; that kind of information is always available in online help, MSDN Library, IntelliSense, and other electronic sources. Instead, the book focuses on understanding the nature of developing applications in the Office environment. The sections on programming are better written and are targeted at what we think is a perfect level for the much broader audience likely to use VBA. We were very pleased with the content, the organization, and especially the comprehensive 60-page index, essential for effective use of this 800-page manual.

The other two print books are "Getting Results with Office 2000 Developer," which was not available for our review, and the "Microsoft Office 2000 Object Model Guide," an update to the ODE 97 version of the same book. The former is supposed to contain installation instructions and other basic information; the installation instructions provided with Microsoft's Reviewer's Guide were confusing in some respects, so we hope the production book is better. The Object Model Guide contains diagrams and information about each Office application's object model, shared components used in all Microsoft applications, other Office 2000 components, data-access components (such as ADO and Data Access Objects), and the so-called "Web Technologies," including Internet Explorer 5. The Object Model Guide is a valuable quick reference to the object models, which can be daunting.

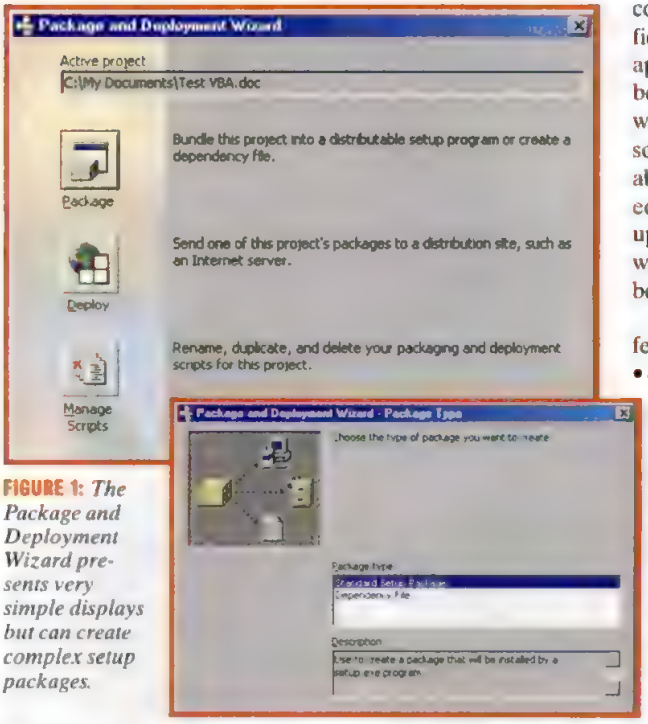

FIGURE 1: *The Package and Deployment Wizard presents very simple displays but can create complex setup packages.*

Printed documentation is an extra-cost option with most tools; typically nothing comes in the box except for the electronic editions on CD. MOD provides not only a printed manual, but a good one.

WHAT'S NEW

Probably the most significant change between ODE and MOD is the treatment of MOD as a full-fledged development environment that includes many of the components available in other Microsoft tools such as Visual Studio. Microsoft clearly wants to make a better impression than it did with ODE, raising this version of Office to the level of a developer product rather than another entry in the productivity suite category. This is made even clearer by the inclusion of VBA in more of the Office applications, making them viable targets for development. In Office 97, Word, Excel, and PowerPoint were fully enabled with VBA. Access 97 used VBA, but the integrated development environment (IDE) was not present. Outlook 97/98 was limited to VBScript. Office 2000 applications with VBA include Word, Excel, PowerPoint, Access, Outlook, and FrontPage. In addition, more components now have an accessible object model, which enables a VBA application to have greater control over the environment.

The presence of the full VBA IDE in Access is jarring, as it breaks with a development style that has been present in Access from its beginning. Our feeling, however, is that Access developers will come to appreciate the more complete integration with the rest of the Office applications and with the VBA-enabled applications from other vendors. And just to be clear, Access's forms-oriented approach, which is strikingly different from all of Microsoft's other development tools, is still available. But when an Access developer creates or edits an Access module, the VBA IDE shows up now, instead of the rather barren editing window that has been with Access from the beginning. It's a big improvement.

Let's take a look at some of the other new features in MOD.

• *COM Add-In Designer.* With other Microsoft development tools such as VB and VC++, programmers can create new ActiveX components and then use those components to extend their applications. This isn't possible with VBA. Office applications have a feature on their Tools menus called *Templates and Add-Ins*, however. The new COM Add-In Designer lets a VBA developer create an *add-in*, a special type of VBA project that results in a DLL; such add-in DLLs can then be loaded by the Office applications for which they were designed. The add-in can be arbitrarily complex; if you can write it in VBA, you can make an add-in out of it.

It's important to understand the difference between an add-in and VBA code attached to an Office document. If you create a little application in an Excel worksheet, that application isn't directly available to Word or Outlook. But an add-in is a DLL and is not connected with a specific document type. That means the DLL can work for any Office application you desire. What MOD is providing here is a powerful way to build extensions for

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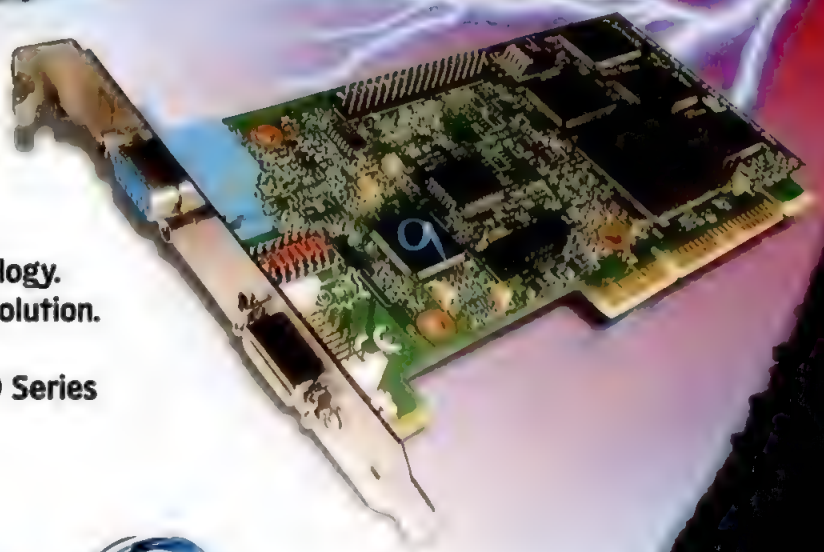

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Office itself, something ODE could not do.

• *Data access.* We've already mentioned the new database ActiveX controls that come with MOD. The presence of these controls is important, not only because they were missing from ODE 97 but also because they provide the MOD developer with the same degree of Microsoft's Universal Data Access as any other Microsoft tool. ADO (ActiveX Data Objects) is the most abstract and therefore perhaps the simplest mechanism for establishing a connection to a database.

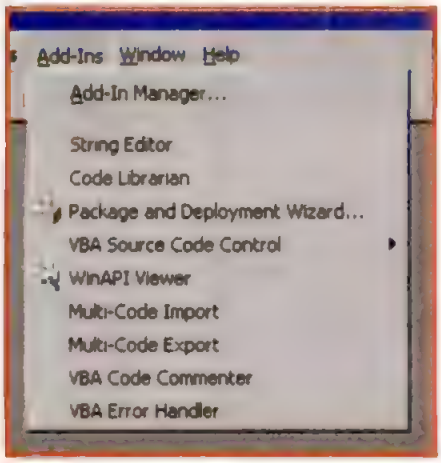

FIGURE 2: *All activated VBA add-ins are displayed on the Tools menu for quick access.*

The Programmer's Guide contains a lot of information about data access, including how to use ADO and plenty of example code. Because MOD developers can use both Data Access Objects and ADO to handle Jet databases, the manual carefully explains the differences and suggests strategies for moving to ADO from Data Access Objects.

Along with the general data-access capabilities, MOD brings two data components over from VB6—the Data Report Designer and the Data Environment Designer. These tools are called designers, because they provide design functionality during code development. In the case of the Data Environment, the designer allows the visual creation of an ADO COM object, which can be used directly at runtime. The object replaces the code a programmer would have had to write in order to provide the same database access.

The Data Report Designer is Microsoft's first generalized report generator. It looks and works very much like the report designer in Access, so it will likely be familiar to the MOD developer. The Data Report Designer is integrated with the Data Environment Designer; you can create a report by simply dragging and dropping a Data Environment on a Data Report. The Data Environment can be used similarly with the FlexGrid control to create hierarchical displays of related data.

As our feature "Office 2000: Should you Upgrade?" in this issue describes, Office 2000 introduces the new Microsoft Database Engine. MSDE, a "lite" or "governed" version of Microsoft SQL Server, is an alternative to Jet (the venerable engine underlying Access), now in Version 4.0. MSDE can also be used by VBA programs through ADO, thus expanding the database alternatives available to the MOD developer. Note that MSDE comes with Office, not with the MOD tools, so it's available without buying MOD.

In addition to providing the license and files to distribute Jet, MOD provides a license to distribute MSDE. The files you need to run Access 2000 with MSDE are in Office, so in some sense this is a paper tiger. If you want to use MSDE with a VBA program, however, you need the controls and drivers that come only with MOD. You can also use MOD as a way to obtain MSDE for use with Visual C++ or Visual Basic. That's important because a new version of Visual Studio isn't scheduled to ship right away, and Microsoft hasn't announced any plans for a service pack upgrade that would include MSDE. We expect Microsoft to include MSDE with all its tools eventually.

The various data-access enhancements to VBA add tremendously to its power and represent a big advance over ODE.

• *VBA add-ins.* MOD provides eight add-ins for VBA that are designed to improve programmer productivity (Figure 2). We've already mentioned the Package and Deployment Wizard. The others are the Code Librarian, VBA Code Commenter, VBA Error Handler, Multi-Code Import/Export, VBA Source Code Control, String Editor, and WinAPI Viewer.

The Code Librarian (Figure 3) is a facility for keeping fragments of code that you commonly use. Microsoft has provided a starter library with hundreds of samples. Whether you can actually use these samples depends on the nature of your work, but even taken just as examples they are very useful, especially because there aren't as many samples in the VB/VBA/MSDN help files any more.

The WinAPI Viewer provides a means to get the exact format for API function declarations and constants, which can be copied into your code. API declarations can be tricky, so this is a useful tool. The Code Commenter inserts a comment block based on a modifiable template at the beginning of subroutines and functions. The tool extracts information about the subroutine or function, grabs the date, and customizes the comments to fit the routine. You can then tailor the comments as you like. Similarly, the Error Handler inserts error-handling code into a routine, also based on a template. If you're putting error handling into many routines, the Error Handler can speed up the process tremendously.

Multi-Code Import/Export are helpful utilities. Unlike VB, which stores its various modules in individual files, VBA keeps all modules within Office documents. This can make it difficult to reuse modules you've created in other applications. The Import/Export utilities let you export a form or module to a file, from which it can be read into a different VBA project.

The String Editor is a strange but useful little tool for assisting in the creation of strings. All too often, a VB/VBA developer will create complex strings by hand and accidentally leave out a concatenation symbol or quotation mark. Given the string

```
x divided by y equals z
```

and after being informed that *x*, *y*, and *z* are the variables, the String Editor will insert

```
x & " divided by " & y & " equals " & z
```

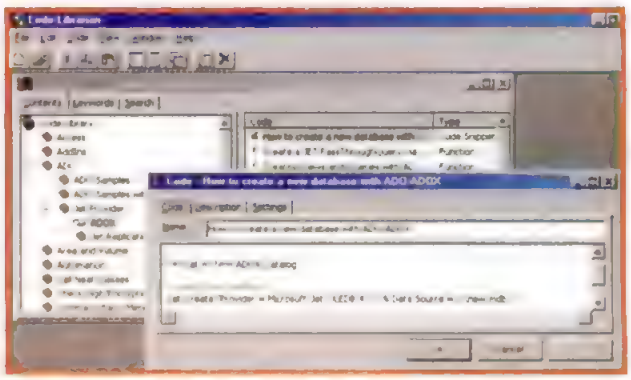

FIGURE 3: *The Code Librarian comes with a lot of useful code snippets, and you can create your own as well.*

We found it awkward at first, but once learned, this little utility clearly can save time.

The Source Code Control tool is simply the means of integrating Visual SourceSafe into VBA.

• *Developer applications.* Four applications are included with MOD: Visual SourceSafe, HTML Help Workshop, Answer Wizard

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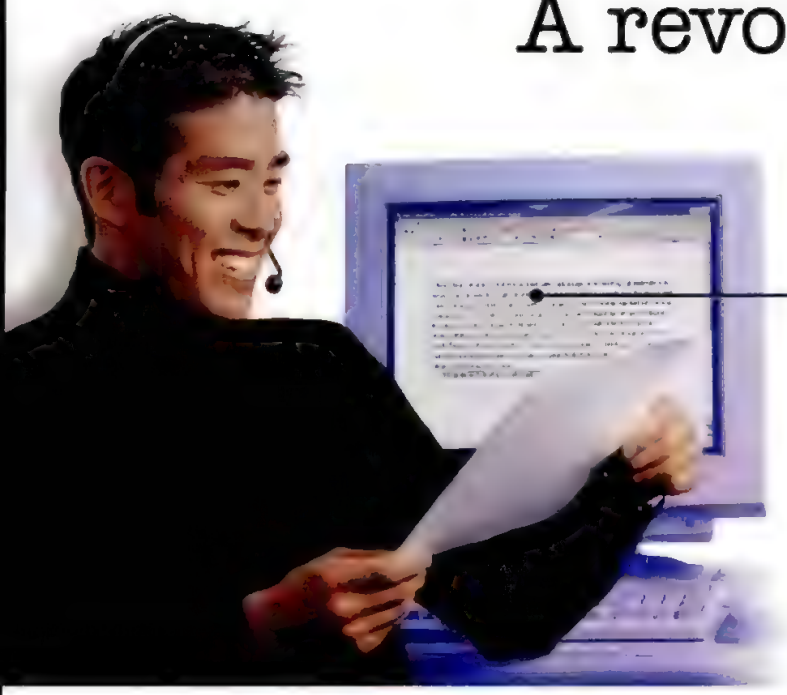

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The occasion is the world's third most important computer show and exposition – **COMPUTEX TAIPEI '99**, a big show on a small island that has become a powerhouse in the world of computer and communications technology.

The show is organized by the China External Trade Development Council (CETRA) and the Taipei Computer Association (TCA).

COMPUTEX TAIPEI, which runs from June 1-5, will play host to more than 800 exhibitors showing the latest technology in nine key product categories.

Categories include (Exhibitors by Product Category as of March 15, 1999):

- Computer Systems (42)
- Communications (98)
- Components (169)
- Motherboards (95)
- Display Equipment (30)
- Overseas Exhibits (62)
- Peripherals (224)
- Software Applications (5)
- Accessories (80)

Top Industry Companies Attend

Most of the major players from the computer, communications and components industries will be at the show – companies such as Acer, Quantum, Toshiba, Texas Instruments, Creative, Cyrix, Motorola, Intel, SGS-Thompson, Fujitsu and Samsung. In addition, many smaller firms with innovative technologies will bring their creative energy to the exhibit halls – from A Plus Info Company to Zyxel Communications, these are the companies with the products and technologies that will help set the stage for the computer and communications advances of the 21st century.

The exhibitors will be showing their wares in 1,500 booths spread over the exhibit floor's 13,500 square meters.

If the 1998 COMPUTEX TAIPEI is any indication, exhibit goers will have a rich selection of products to choose from – at last year's show, more than 4,000 computer products were on display. Among the exhibits will be:

Computers – Taiwan is the largest producer of notebook computers in the world and accounts for more than 10 percent of the world market in desktop PCs. Exhibits will reflect the continuing trend toward lower prices and higher functionality. Featured will be Pentium III desktop and notebook PCs. In addition, new PDAs, wallet PCs and other personal, portable information appliances will have a strong presence.

Communications – The Internet is at the heart of a new global networking infrastructure and the COMPUTEX TAIPEI exhibits will reflect the explosion of products and services that are flocking to this marketplace. Taiwan is currently the largest modem supplier in the world and 56Kbps models will be a staple at the show. The country also supplies nearly 60 percent of the world's Ethernet cards and has captured 35 percent of the market in Ethernet hubs. Other exhibits will showcase products for ADSL, ISDN, LAN, Frame Relay, ATM, and other communications technologies, including routers, bridges, parallel buffer distributors, gateways, hubs and other essential communications gear. PDAs, set-top boxes and Internet phone technology will be on display as well.

Components – Here exhibit attendees will find a complete range of discrete IT components and parts from around the world ranging from ICs, chips and chipsets and microprocessors to batteries, cases, connectors, power supplies and floppy and hard disk drives.

Motherboards – Taiwan is also a world leader in this category. In addition to motherboards (including those clocking in at 133MHz), look for a bounty of cards for graphics, sound and video, I/O, memory, MPEG, networking interface, as well as UCB and PCMCIA connectivity.

Displays – Here the latest in LCD and flat screen technology (including TFT-LCD and DSTN-LCD) will hold a prominent position, reflecting the nearly 60 percent market share held by Taiwan companies. On hand will be professional desktop monitors, notebook monitors, multimedia monitors, plasma display panels, terminals and touch screens.

Overseas Exhibits – Exhibitors from foreign countries will exhibit in a special area, showing products that range

Builder, and the Microsoft Agent SDK. We've already mentioned SourceSafe.

The HTML Help Workshop is probably the best help-file editor Microsoft has ever produced. Of course, Microsoft has really lagged in this area. For years the only way to build Windows help files was with Word, RTF files, and a command-line help compiler. So though it may not be the best help-file creator around, it is complete and a real step forward. The only catch is that it creates HTMLHelp rather than WinHelp files, but that's the direction Microsoft is moving toward anyway.

The Answer Wizard Builder provides a means to build a kind of natural language query interface to an HTML Help file. You use the tool to create associations between questions and the relevant topics in an existing help file. Then your application can have the same kind of interface that Office itself does with the Office Assistants.

Speaking of the assistants, the MS Agent SDK provides an Agent Character Editor for use with the Agent Server, the service that runs the assistants. You can thus design your own animated characters for as assistants. Office Assistants have their own object model, so they can also be manipulated by your VBA program code.

PRACTICAL MATTERS

There are very few things to complain about in MOD 2000, but we did find the installation a bit annoying. Because MOD is really two products in one box, there are actually two installation procedures. You install Office Premium first, followed by the MOD toolkit components. The Office installation is self-contained except for the installation of MSDE, which required a separate process. The MOD toolkit installation involves up to six separate operations: one for each of the four developer applications, one for the developer tools, and one for MSDN.

The problem is that each of these six items is an independent program or component that is part of other development environments. MSDN, for example, comes with all Microsoft developer tools. It's likely that Office development's broader reach will include many less-experienced developers, so we think Microsoft should make this process easier the next time around by having an integrated installer, including something to automate MSDE's setup.

MOD 2000 sells for an estimated street price of $1,000. An upgrade from ODE 97 has a street price of $610. In case you already own a copy of Office 2000 Premium or want to enable MSDE for VC++ or VB6, the MOD 2000 Developer Toolkit is $400. Note that the Developer Tools can be used with any version of Office 2000, not only the Premium edition. If all you intend to do is develop Word macros or programs, you can add the toolkit to the less expensive Standard edition. If you get a version of Office with the purchase of a new computer, buying the toolkit is the way to go.

For developers concentrating on Office development—and we think the number is growing—MOD is a sound investment as long as they don't already own VB6. For the general market, a close examination of the MOD features is necessary to make sure they will deliver value. In general, Microsoft has done an excellent job converting the nearly worthless ODE into a full-fledged development tool that can't be ignored. PC

Will Fastie is a frequent contributor to PC Magazine.

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TAIPEI INTERNATIONAL COMPUTER SHOW

from PCs, workstations, servers and peripherals to key components such as CPUs and chipsets.

Peripherals – Printers, plotters, speakers and microphones will be joined by input devices such as optical pens, digitizers and touch-pads. Digital cameras will return this year in a starring role. CD-ROM drives (including 50X, 56X and DVD-ROM), keyboards, mouse, and scanners will be very much in evidence based on Taiwan's strong presence in these areas in the world's markets. Also look for set-top boxes, POS terminals, UPS systems, joysticks, video converters, bar code readers, handwriting input devices and products for video conferencing.

Software Applications – Taiwan's software business is expected to hit $3 billion by the end of this year with a 20 percent annual growth rate. On display will be the full range of application, operating system and utility packages including the latest offerings in multi-media and anti-virus software. Internet-related software will hold an even more prominent place in this year's show. Educational and entertainment packages will also be featured.

Accessories – Among the exhibits will be cables and plugs, ribbons, cartridges, display filters, maintenance and cleaning kits, plastic fixtures, storage and filing devices, and all the other mundane but important items that make the world of computing and communications possible.

Speakers Examine the Latest IT Trends

Adding another dimension to this year's COMPUTEX TAIPEI will be a series of keynote presentations and panel discussions held on June 2 that will explore the latest trends in the world of IT.

What will the IT industry in the 21st century look like? NEC's former chairman and now a counselor and board member, Sekimoto Tadahiro, will chart the future of the IT from a perspective enriched by nearly 50 years in the industry.

John Davis, vice president of Intel, and TSMC's CEO Morris Chang will discuss how the new IC technologies are challenging traditional electronic applications. Cisco's vice president Williams R. Nuti and Dr. Shyue-Ching Liu, CEO of Chunghwa Telecom, will focus on the incredible impact the Internet is having on the communication industry. Also on tap to discuss industry trends are Brian Halla, CEO of National Semiconductor and Stan Shih, the CEO of Acer Computer.

The conference program includes Seagate's vice president Joel Stead who will spell out how network, computer and broadcasting applications influence the future of peripheral products. In the final keynote presentation, Toshio Kimura, Epson's senior managing director, discusses on-demand printing solution in the 21st century. All the keynotes and panels will be presented in English with instantaneous Chinese translation.

Among those expected to join the Taiwanese IT professionals walking the aisles and attending the sessions will be conference goers from Japan, USA, Hong Kong, Korea, Singapore, Germany, Malaysia, United Kingdom, France and Canada as well as many other countries from around the world.

The Little Dragon Roars

What will draw these attendees to Taiwan in June is the vitality of this Asian powerhouse's IT industry which has earned the country the name of "Silicon Island" and the status of one of the region's "Little Dragons" Taiwan was able to avoid the worst of the recession that hit other Eastern and Southeastern Asia countries – in fact it even posted modest growth over the past several years. Contributing to Taiwan's success in the face of the general Asian recession is its conservative banking system and the fact that its IT industry is made up of many small and medium sized companies which spreads the risk in a shaky economy.

Despite emerging relatively unscathed from the Asian financial crisis, the lessons of the downturn were not lost on the Taiwan IT industry. As a result it is adopting several new strategies to continue its preeminence. For example, the industry is now providing total solutions services for its international buyers, not just production values. As a result, buyers such as Compaq, Dell, IBM, Fujitsu and NEC will be basing their OEM orders on criteria in which low production costs are only one factor.

In addition, the Taiwan IT industry is committed to dramatically shortening time-to-market for each generation of products. A good example is the rapid transition from CRTs to LCDs made by seven Taiwan IT vendors who have invested more than US$4.6 billion according to MIC (Taiwan's Market Intelligence Center). The IT industry is also developing high end products such as servers as well as stressing innovation in many of its top-selling lines.

At **COMPUTEX TAIPEI'99**, it will be obvious that this "Little Dragon" has grown up.

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(Senior Managing Director of Seiko Epson Corporation)

Mr.William R. Nuti
(Vice President of Cisco)

Mr. Joel A. Stead
(Senior Vice President of Seagate)

Dr. Sekimoto Tadahiro
(Counselor & BOD and Ex-Chairman of the Board of NEC)

Panelist

Dr. Morris Chang
(Chairman of TSMC)

Dr. Shyue-Ching Lu
(President and CEO of Chunghwa Telecom Co., Ltd)

Mr. Stan Shih
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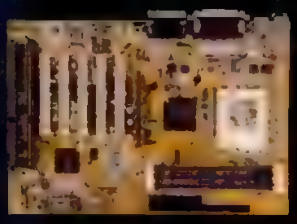

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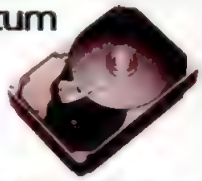

◆ Interface: Ultra2 SCSI ◆ Transfer rate: [illegible] ◆ Average seek time: [illegible] ◆ Rotational speed: [illegible] rpm ◆ 1024KB data buffer ◆ 5-year warranty

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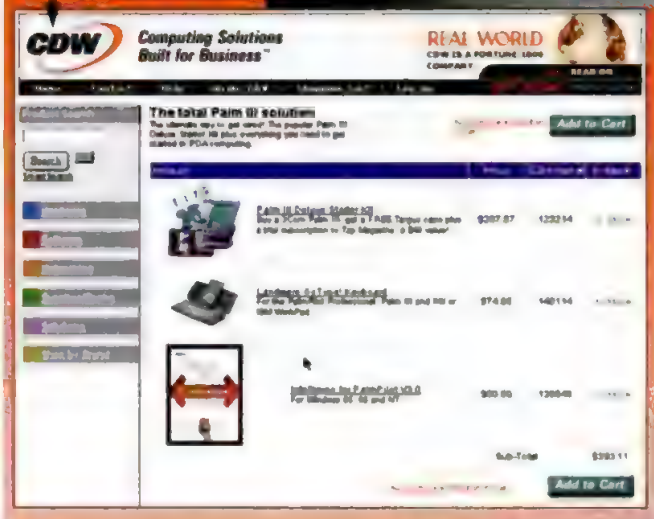

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*Windows 95. **Windows 98.

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#44117	1675	380 AMD-K6-2	64	6.4GB	2X-DVD	14.1" TFT	56K	Win 98	$2,399
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#42537	PCGF180	333PII MMX	64	4.3GB	DVD	14.1" TFT	V.90	Win 98	$2,199
#42538	PCGF185	366PII MMX	64	6.4GB	DVD	13.3" TFT	V.90	Win 98	$2,899
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#42558	PCG505TS	300P MMX	64	4.3GB	—	10.4" TFT	V.90	Win 98	$1,799
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#44252	330	500 PIII MMX	128/384	10GB	40X	56K	T/D	Win 98	$2,069
#44793	330	500 PIII MMX	128/384	10GB	40X	56K	T/D	Win NT	$2,169
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#36314	10000CDS	400 PII MMX	64	10.0GB	32X	—	T/D	Win 95	$1,349
#44789	6400	450 PIII MMX	64/384	6.4GB	—	—	T/D	Win 95	$1,429
#36315	10000CDS	450 PII MMX	64	10.0GB	32X	—	T/D	Win 95	$1,519
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#42213	5264	450 AMD-K6-2	128MB	18GB	DVD	1 SDSL	MT	Win 98	$1,899
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#44438	4455	400 Celeron	64	6.4GB	32X	56K	MT	Win*98	$899	—
#44481	6465	433 Celeron	96	9.8GB	32X	56K	MT	Win*98	$1,099	—
#44457	6452	466 Celeron	96	19GB	32X	56K	MT	Win*98	$1,299	$39
#43849	6452	450 PIII MMX	96	13.8GB	32X	56K	MT	Win*98	$1,399	$41
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#42395	6275B5U	350 PII	32MB	4.2GB	—	W98	DT	$1,049
#42396	6275F1U	366 Celeron	32MB	4.2GB	32X	W98	DT	$1,099
#42137	628761U	400 PII	32MB	4.2GB	—	W98	MI	$1,099
#42392	6275B4U	350 PII	64MB	4.2GB	—	NT	DT	$1,179
#42397	6275M2U	400 PII	32MB	4.2GB	—	W98	DT	$1,179
#42394	6275B7U	350 PII	32MB	4.2GB	32X	W98	DT	$1,199
#42411	6275G1U	366 Celeron	64MB	8.4GB	32X	W98	MT	$1,229
#44405	6275R1U	433 Celeron	64MB	4.2GB	—	W98	MT	$1,359
#42139	628769U	400 PII	64MB	8.4GB	32X	NT	MI	$1,399
#42140	628785U	450 PII	64MB	8.4GB	32X	W98	MI	$1,429
#42142	628786U	450 PII	64MB	8.4GB	32X	NT	MI	$1,469
#44365	627583U	450 PIII	64MB	4.2GB	40X	W98	MT	$1,719
#44398	627594U	500 PIII	64MB	8.4GB	40X	W98	MT	$2,079
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- EN C400 64MB 6GB ETH (D8660-002) 1178 37

HEWLETT PACKARD
- 7143B C333 32MB 4GB 32X (D7670T#ABA) 733 20
- [illegible] 992 30

IBM
- PC300GL C333 32MB 3GB (62752JU) 872 79
- [illegible] 823 04

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- ACERPOWER P2-400 32MB 6GB 32X (6100-400A) 1112 03

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- EP P3-500 64MB 6GB (38617-007) 1673 80
- EN P2-450 64MB 6GB 32X ETH (D26650-004) 1767 20

HEWLETT PACKARD
- 8532 P2-400 64MB 8GB 32X (D6632B#ABA) 1278 14

IBM
- [illegible] 1440 33
- PC300PL P3-500 64MB 13GB 40X(6862N4U) 2196 40

NOTEBOOKS

ACER
- 501DX 266 32MB 3GB 20X 56K 12.1 (501DX) 1160 42
- 503T 300 32MB 4GB 20X 56K 12.1 (503T) 1647 80

COMPAQ
- 1750 300 64MB 4GB 24X 56K 13.3 (318530-002) 2621 23
- 3500 366 64MB 6GB 13.3 (310400-001) 3646 20
- 7800 366 64MB 14GB 56K 14.4 (388741-002) 4829 07

FUJITSU
- L440 266 32MB 4GB 56K 13.3 (FPCD40044) 2284 84
- E370 366 64MB 6GB 24X 56K 13.3 (FPCD30192) 3013 98

HITACHI
- 600 266 64MB 3GB 24X 56K 10.4 (PCSNP1-A2A2165B) 1872 93
- 300 64MB 6GB 24X 56K 13.3 (775-001) 2363 91

HEWLETT PACKARD
- XE 266 32MB 4GB 24X 56K 12.1 (F1719WT#ABA) 1478 86
- 900 300 32MB 4GB 12.1 (F1711WT#ABA) 2464 05
- 4150 333 64MB 6GB 24X (F1640WT#ABA) 3433 87

IBM
- 380Z 300 32MB 4GB 24X 13.3 (2635JGU) 2386 27
- [illegible] 2782 08
- 600E 366 64MB 6GB 24X 13.3 (26454AU) 3727 27
- [illegible] 3832 58

NEC
- VERSA NOTE 233 32MB 3GB 24X 56K 12.1(VN230010) 1665 43
- VERSA SX 300 64MB 4GB 24X 14.1 (VS450A30) 2727 22
- VERSA LX 300 32MB 4GB 24X 14.1 (VL450A20) 2922 09

TOSHIBA
- 4020CDT 300 64MB 6GB 24X 56K 13.3 (PAS402U-T2CW82) 2421 27
- 7010CT 300 32MB 4GB 56K 12.1 (PAP701U-T2N4) 2809 58
- [illegible] 3102 58

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- 16MB EDO 72PIN 4X32 (A324004-60T) 36 81
- 16MB NP 72PIN 4X32 (A324000-60T 39 77
- 16MB PARITY 72PIN 4X36 (A364000-60T) 47 88
- 32MB PC100 168PIN SYNC (A168564/32A) 52 56
- 32MB EDO 72PIN 8X32 (A328004-60T) 73 23
- 32MB NP 72PIN 8X32 (A328000-60T) 77 34
- 32MB PARITY 72PIN 8X36 (A368000-60T) 94 69
- 64MB PC100 168PIN SYNC (A168564/64A) 98 43
- [illegible] 215 91

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- ETHERLINK XL PCI 10BT NIC (3C900B-TPO) 50 18
- USB NETWORK INTERFACE 10BT (3C19250) 57 03
- FAST ETHER XL PCI TX NIC (3C905B-TX) 83 64
- FAST EHTER SERVER NIC (3C980B TX) 105 70
- GIGABIT ETH SERVER NIC (3C985B SX) 680 58
- OFFICECONNECT ETH HUB 4-RJ45 (3C16704) 44 87
- OFFICECONNECT ETH HUB 8-RJ45 (3C16700) 75 78
- OFFICECONNECT FETH HUB 4-RJ45 (3C16723) 95 05
- OFFICECONNECT ETH HUB 16-RJ45 (3C16702V 163 49
- OFFICECONNECT FETH HUB 8-RJ45 (3C16722) 171 10
- OFFICECONNECT FETH HUB 12-RJ45 (3C16721) 300 37

INTEL
- PRO/100+ PCI NIC 10/100BTX (PILA8460V 78 29
- PRO/100+ MGMT PCI RJ45 NIC (PILA8461) 82 56
- PRO/100+ SVR PCI 100BTX RJ45 NIC (PILA8470) 94 02
- INBUSINESS 5PT HUB ETH RJ45 (SH10T5US) 45 05
- INBUSINESS 8PT HUB ETH RJ45 (SH10T8US) 57 07
- INBUSINESS 4PT FETH HUB RJ45 (SH100TX4) 94 73
- INBUSINESS 8PT FETH HUB RJ45 (SH101TX8US) 208 67

LINKSYS
- USB NETWORK INTERFACE 10BT (USB10T) 30 56
- ETHERFAST 10/100 NIC PCI (LNE100TX) 25 64
- NETWORK STARTER KIT PCI (EW5PCISK) 58 32
- FASTETHERNET STARTER KIT PCI (FENSK04) 103 58
- ETHERNET 5PORT WORKGROUP HUB (EW5HUB) 33 39
- ETHERNET 10PORT WORKGROUP HUB (EW10HUB) 56 53
- ETHERFAST 5PORT 10/100 HUB (EFAH05W) 85 48
- ETHERFAST 16PORT 10/100 HUB (EFAH16W) 256 41
- ETHERFAST 10/100 12PORT SWITCH (DSSX12) 603 98

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- 10/100 NIC PCI (FA310TX) 23 67
- NETWORK KIT 10MBS PCI (SB104) 74 78
- NETWORK KIT 100MBS PCI (FB104) 119 49
- ETHERNET HUB 8PORT (EN308) 86 12
- FASTETHERNET HUB 8 PORT (FE108) 131 73
- ETHERNET SWITCH 8PORT (SW108) 179 91
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3COM-PC CARDS
- MEGAHERTZ 56K WINMDM (3CCM356) 149 70
- MEGAHERTZ 56K GLBL MDM (3CCM156B-US) 190 87
- MEGAHERTZ 56K+LAN (3CCFEM556B) 231 33

XIRCOM-PC CARDS
- REALPORT 56K MODEM (RM56V) 121 81
- REALPORT LAN ONLY (RE 100BTX) 133 92
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3COM-DESKTOP
- [illegible] 67 46
- USR 56K V90 FXMDM (005687-0) 105 12
- USR 56K V90 FAXMODEM (005686-3) 121 41
- USR 56K V90 VCE INT (005685-0) 131 41

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- SUPRMAX 56K PCI (SM56IPC-XL1) 51 94
- SUPRAEXP 56K V90 INT (XPR56IPC XL1S) 87 48
- SUPRAEXP 56K V90 EXT (XPR56EPC XL1S) 104 84
- SUPRASONIC® 112K V90 INT (SS2I-RET) 131 93

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BROTHER
- [illegible] 286 94
- HL 1050 10PPM 1200DPI (HL 1050) 382 27
- MFC 7150C 6PPM 1440DPI (MFC 7150C) 483 73
- [illegible] 573 19
- [illegible] 809 32

CANON
- BJC 250 4PPM 720DPI (O30-2250-US1) 96 18
- BJC 1000 4PPM 360DPI (O30-3020-US1) 116 05
- BJC 2000 5PPM 720DPI (O30-3010-US1) 140 37
- [illegible] 188 13
- BJC 5000 7 5PPM 1440DPI (O30-2800-US1) 188 81
- [illegible] 235 16
- MULT PASS L6000 600DPI (H12 1062 US1) 562 83

EPSON
- STYLUS CLR 440 720DPI (C255001) See Web!
- STYLUS CLR 640 1440DPI (C258001) See Web!
- STYLUS CLR 740 1440DPI (C257001) See Web!
- STYLUS CLR 850 1440DPI (C251001) See Web!
- STYLUS CLR 900 1440DPI (C265001) See Web!
- STYLUS CLR 3000 1440DPI (C203011B) See Web!
- STYLUS CLR 1520 1440DPI (C211001) See Web!

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- [illegible] 182 10
- [illegible] 283 10
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- DESKJET 1120C(I 4 5PPM 600DPI (C2680A#ABA) 462 02
- OFFICEJET 720 MULTIFUNCTION (C8662A#ABA) 504 38
- [illegible] 554 59
- 2500CXI 9 5PPM 600DPI (C2687A#ABA) 824 83
- LASERJET 1100AXI MULTIFUNCTION (C4219A#ABA) 983 49
- LASERJET 1100XI 8PPM 600DPI (C4225A#ABA) 363 29
- LASERJET 2100X 10PPM 1200DPI (C4139A#ABA) 655 11
- LASERJET 3100XI MULTIFUNCTION (C4177A#ABA) 963 49
- LASERJET 4000 17PPM 1200DPI (C4118A#ABA) 1088 75
- LASERJET 5000 16PPM 1200 DPI (C4110A#ABA) 1429 94
- [illegible] 2210 87
- LASERJET 8100 32PPM 1200DPI (C4214A#ABA) 2561 98

LEXMARK
- 1100 CLR 3PPM (17Z0050) 98 99
- 3200 CLR 6PPM (17D0000) 106 67
- 5700 CLR 8PPM (17A0000) 221 05
- 5770 CLR PHOTO 8PPM (17A0650) 270 05
- OPTRA E+ 6PPM (11A7530) 331 41
- 4079 PLUS CLR 1PPM (4079002) 1358 41
- OPTRA SC1275 12PPM (11C0201) 2330 00

OKIDATA
- OKIPAGE 8W 8PPM (62413701) 241 68
- OKIPAGE 6E 6PPM (62412601) 259 54
- OKIPAGE 10EX 10PPM 1200DPI (62412702) 358 97
- OKIPAGE 20DX 20PPM (62413204) 876 88

NEC
- SUPERSCRIPT 870 8PPM 600DPI (870) 316 61
- SUPRSCRIPT 1260 12PPM 600DPI (1260) 579 66
- [illegible] 840 35
- SUPERSCRIPT 4400 CLR 4PPM 600DPI (4400) 1987 83

XEROX
- DOCUPRINT P8E 8PPM 600DPI (E,US) 328 87
- DOCUPRINT P12 12PPM 600DPI (P4U) 963 67
- WORKCENTRE 450CP MULTIFUNCTION (ESG) 295 08
- DOCUPRINT N24 24PPM 600DPI (Y1U) 2210 48

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IOMEGA

ZIP
- 100MB ATAPI INT (10870) 92 27
- 100MB PAR/SCSI EXT (10032) 115 25
- 100MB EXT USB (110300 119 24
- PLUS 100MB PAR/SCSI EXT (10860) 153 95
- 100MB COMPAQ ARMADA 7700 (11018) 181 03
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- 2GB INT SCSI DRIVE (13046) 316 50
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- DITTOMAX 7GB INT (10869) 182 26
- DITTOMAXPRO 10GB INT (10861) 258 64

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- [illegible] 148 00
- 8 4GB UDMA HD (90845D4) 185 48
- [illegible] 233 9
- 17 2GB UDMA HD (91728D8) 301 98

SEAGATE
- 6 5GB UDMA HD (ST36531A) 136 40
- 8 6GB UDMA HD (ST38641A) 151 92
- 10 2GB UDMA HD (ST310240A) 181 64
- 6 5GB SCSI HD (ST365.30WC) 263 34
- 9 1GB SCSI HD (ST19101N) 411 11

WESTERN DIGITAL
- 8 4GB UDMA HD (AC38400) 109 20
- 10 1GB UDMA HD (AC310100) 103 48
- 13GB UDMA HD (AC313000) 231 05
- 4 3GB SCSI (E4360-0003) 339 54
- 9 1GB SCSI (E9100-00080 423 35

CD-WRITERS

HEWLETT PACKARD
- CDWRITER PLUS 7200I INT IDE (C4380A#ABA) 271 25
- CDWRITER PLUS 7200E EXT/PAR (C4381A#ABA) 361 41
- CDWRITER PLUS 8100I INT IDE (C4392A#ABA) 222 88

HI-VAL
- 2X24X2 IDE INT CD-RW (H2242A-00R) 250 97

MICROSOLUTIONS
- BACKPCK 2X/6X EXT (190126) 417 20

MITSUMI
- 8X/4X/2X IDE CDR (CR-4802TE) 261 36

PHILLIPS
- CDRW 2X/8X INT EIDE (PCA363RW) 317 86

RICOH
- CDRW 6X/2X/2X INT EIDE (3324000 295 95
- CDRW 4X/4X/20X INT EIDE (3327001 373 74

SMART AND FRIENDLY
- 226 INT 2X/2X/6X (SAF775 413 14

SONY
- CDRW 24X/4X/2X INT EIDE (CRX100E/CH 298 98

YAMAHA
- CDRW 16X/2X/2X INT IDE (CRW2216E 287 71

DIGITAL CAMERAS

AGFA
- EPHOTO 780 (EPHOTO780) 272 80
- EPHOTO 1280 (EPHOTO1280) 338 22
- EPHOTO 1680 (EPHOTO1680) 643 64

CANON
- A5 POWERSHOT (F92 1007-US1) 470 00

CASIO
- QV7000SX (QV7000SX) 604 79
- [illegible] 388 32

CREATIVE LABS
- VB WEBCAM II USB (5000001070) 89 84
- VB WEBCAM II PAR/PT (5000001048) 89 86

EPSON
- PHOTOPC 700 CLR 4MB (B073011F) [illegible]
- PHOTOPC 750Z (B080011F) [illegible]

FUJI
- [illegible] 444 21
- MX 700 (MX 700) [illegible]
- [illegible] 2070 12

KODAK
- DVC323 CLR VIDCAM USB (8022998) [illegible]
- DC210 PLUS (8209835) 449 66
- DC220 CLR 8MB (1993476) [illegible]
- DC260 8MB (8481798) [illegible]

MINOLTA
- SNAPPY VIDCAPTURE (31-0300) 89 84

NIKON
- COOLPIX 950 (25043) [illegible]

OLYMPUS
- D-340R (225000) [illegible]
- D-400Z ZOOM (225006) 741 66
- D-600L ZOOM (225050) 744 12
- [illegible] 1117 32

PANASONIC
- EGGCAM iGP (KR001) 98 83

PHILLIPS
- USB PC CAMERA (PCA645VC) [illegible]

RICOH
- RDC300Z (776190) 367 76
- [illegible] 372 27
- RDC4200 (776210) 479 90

SONY
- MVC FD61 MAVICA (MVC FD61) 472 42
- MVC FD7 MAVICA (MVC-FD7) [illegible]
- MVC FD71 MAVICA (MVC-FD71) [illegible]
- MVC FD81 MAVICA (MVC FD81) 762 20
- MVC FD91 MAVICA (MVC FD91) 841 86

TOSHIBA
- [illegible] 388 18
- PDR M1 (PDR M1) 387 46

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SOFTWARE

MICROSOFT
- WINDOWS 98 UPGRADE (730-00002) 91 16
- WINDOWS NT WORKSTATION UPGRADE (236-01564) 126 63
- OFFICE97PRO UPG (353-00014 [illegible]
- WINDOWS NT SERVER V 4 10-USER UPGRADE (227-01248) 367 60

NOVELL
- NETWARE 5 5-USER (I8826442383261 741 44

SYMANTEC
- ANTIVIRUS V 5 (07-00-02307) [illegible]
- WINFAX PRO 8 (12-00-02540) 103 91
- PCANYWHERE HOSTAREM (07-00-02077) 148 33
- ACT! V 4 0 (06-00-00620) [illegible]

POWER PROTECTION

APC
- BACKUPS OFFICE 280 (BF280 78 73
- BACKUPS 300 (BK300 84 82
- [illegible] 118 46
- BACKUPS PRO 350 (BP350U 166 21

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- INTERNET OFFICE 280 (INTERNET OFFICE 280) 74 52
- [illegible] 78 76
- [illegible] 142 67

PDAS

3COM
- PALM VII 2MB (80300U) 248 56
- PALM IIIX (80301U) 322 87
- PALM V (80400U) 382 88

CASIO
- CASSIOPEIA E 11 8MB (E 11) 273 44

COMPAQ
- 810 8MB (314520-001) 388 76
- 2010C 20MB 33.6K (314550-001) 636 00

GOLDSTAR
- GOLDSTAR PHEN EXP 32MB 56K (H 220C32) 649 56

HEWLETT PACKARD
- PALMTOP 200LX 2MB F1061A#ABA 428 11
- PALMTOP 360LX 8MB (F1238A#ABA 513 91
- PALMTOP 620LX (F1250A#ABA 642 59
- JORNADA 820 PALM (F1260A#ABA 766 52

NEC
- MOBILEPRO 770 (MC R520A [illegible]
- MOBILEPRO 800 (MC R700A [illegible]

PHILLIPS
- NINO 301 (NN010202-NA) 229 96
- NINO 312 (NN010302-NA) 317 20
- NINO 320 (NN010303-NA) 361 41
- VELO 500 (VL030403-US) 311 20

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AGFA
- SNAPSCAN 1212U USB (SNAP1212U/PC) 121 29

HEWLETT PACKARD
- SCANJET 4100CXI (C6293A#ABA) 188 34
- SCANJET 5100CXI (C5193A#ABA) [illegible]
- [illegible] 361 47
- SCANJET 6250CXI (C6275A#ABA) [illegible]

MICROTEK
- SLIMSCAN C6 (1108-03-4600002) 90 03
- SCANMAKER X6 USB (1108-03-410730) [illegible]
- SCANMAKER 35T (1108-03-172020) 606 37
- SCANMAKER 4 36BIT (1108-03-420006) 631 26
- SCANMAKER 6400XL (1108-03-360110) 819 52
- SCANMAKER 9600XL (1108-03-360030) 1379 86

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- [illegible] 184 13

UMAX
- ASTRA 1220P (SPKG-13410) [illegible]
- ASTRA 1220U USB (SPKG-13423) 139 77
- [illegible] [illegible]
- ASTRA 1200S (SPKG-13408) [illegible]
- POWERLOOK II (SPKG-13120) 1110 57

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- PAPERPORT 6100 (P6-65001-W/B0 [illegible]
- PAPERPORT ONE TOUCH 5300 (P3-85001-W) 118 81
- PAPERPORT STROBE (PSP-55001-W) 186 00

VIDEO CARDS

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- [illegible] 52 39
- XPERT 128 16MB AGP (100-416020) 94 23
- ATI-TV WONDER 100 (103060) 76 82
- [illegible] 141 26
- RAGE FURY 32MB AGP (100-416043) 158 37
- ALL-IN-WONDER 128 AGP (100-708029) 190 31

CREATIVE LABS
- 3D BLASTER VOODOO 2 12MB PCI (5086701000) 130 21
- GRAPHICSBLASTER RIVA TNT AGP (5057111002) 93 19
- [illegible] 114 01

DIAMOND MULTIMEDIA
- MONSTER FUSION PCI (90150073) 127 42
- MONSTER 3D II PC 8MB ADD-IN (MON3DIIB-XL1) 130 22
- STEALTH II G460 AGP 64BIT 8MB (STIIG460B-XL1) 95 85
- VIPER V330 8MB PCI 2D 3D ACCEL (VPRV330PCI8XL5) 85 86
- VIPER V550 AGP 16MB 128BIT (VPRV550A16-XLS) 129 12

STB
- VELOCITY 4400ST AGP 16MB (V41416) 130 22

MONITORS

ARQON
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- 15IN 28MM 1280X1024 (T570) 188 95
- 17IN 27MM 1280X1024 (T770) 279 95
- 17IN 25MM 1600X1280 (T785) 329 95
- 19IN 26MM 1600X1280 (T998) 489 95
- 21IN 25MM 1600X1280 (T107) 859 95
- 15IN LCD (TP15) 949 95

NEC
- MULTISYNC A700+ 17IN 28MM LC 1739(VWV) 324 84
- MULTISYNC A900 19IN 28MM LC 1943(AWV) 507 23
- MULTISYNC 1510V 15IN (LA 1522)MVV 1214 33
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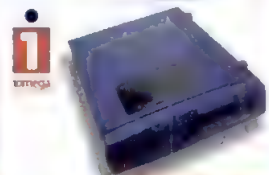

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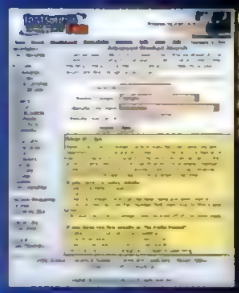

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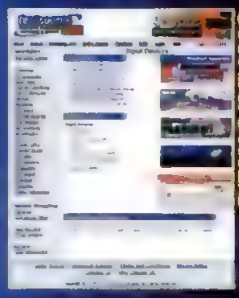

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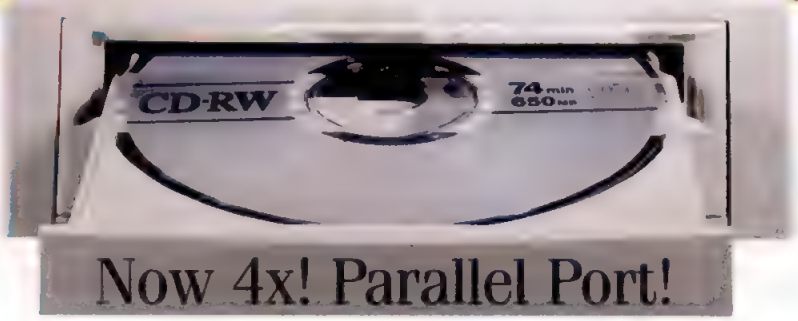

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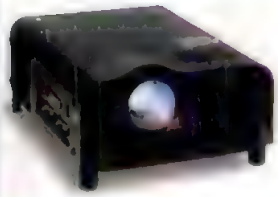

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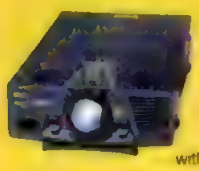

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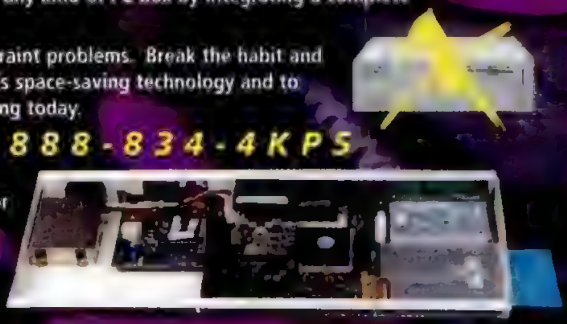

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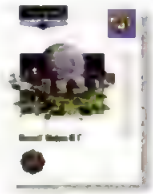

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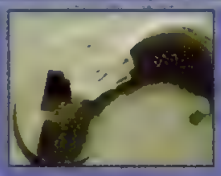

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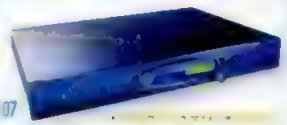

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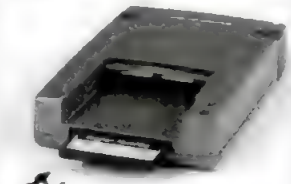

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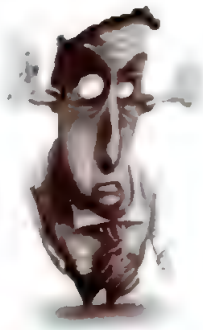

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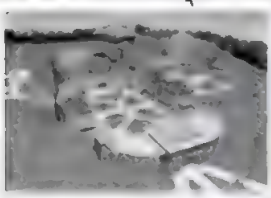

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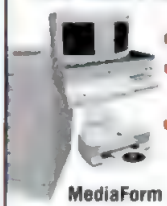

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PRINT PRODUCTIVITY

Read The Fine Print

By Sally Wiener Grotta and Daniel Grotta

Despite the tremendous growth of the Internet and e-mail, print is still essential in personal communications. This is why inexpensive color ink jet printers have become so ubiquitous and store shelves are full of print software from which to choose. Using the theme of a graduation party, PC Magazine *tested six print programs—Canon's ColorStore Print Projects ($25 street), Microsoft Home Publishing 99 ($55), Sierra Home's Print Artist Platinum 4.5 ($50), Corel's PrintHouse Magic 4 Premium ($40), Mindscape's PrintMaster Platinum 7 (CD $40; DVD, $50), and Broderbund's The Print Shop Deluxe 6.0 ($50).*

Though all of the packages are worth their price, we selected Print Shop as our Editors' Choice because of its great combination of features and functionality.

GETTING STARTED

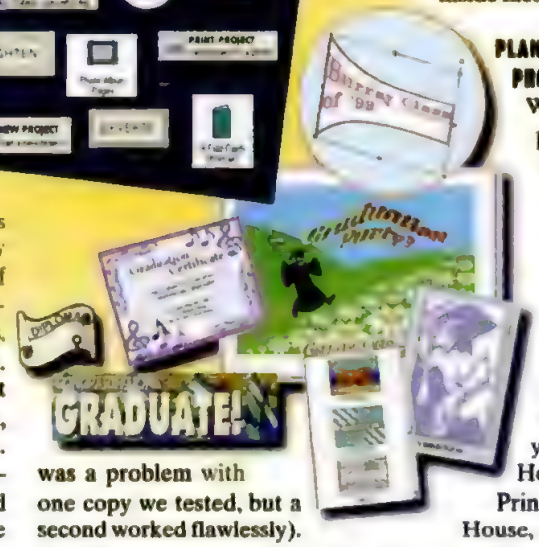
On the surface, these programs look very much alike. Open any one and you'll have a choice of projects—greeting cards, business cards, stickers, banners, crafts, letterheads, and so forth. You then either select a project template or create your own, and you begin to personalize it. Add your individual touches—edit or replace graphics and change text—and voilá: You've created a beautiful customized piece ready for output.

This similarity, however, is skin-deep. One of the most touted differences is the amount of content included (clip art, fonts, borders, and so forth). But we found more significant distinctions in interface style, workflow, features, and target audience.

Home Publishing and PrintHouse will appeal to novice users, because they offer wizard-like step-by-step guidance, though more experienced users will not be constricted by the interface. PrintMaster has a voice-over helper that you can turn off, so it might be good for families with varying levels of computer sophistication. PrintMaster also has an unpatched bug that prevents its help menu from displaying (this was a problem with one copy we tested, but a second worked flawlessly). ColorStore, Print Artist, and Print Shop are for the more computer-savvy.

Often, it's the small details that make the difference. For instance, in that first series of choices (when you select a project), ColorStore, Print Artist, and PrintMaster seem to have things turned around. They require you to decide how a greeting card will be folded before you choose your style. So if all you know is that you want a graduation card, you must waste time searching through the various fold categories, template by template, to see which ones might fit your gift. On the other hand, Home Publishing, PrintHouse, and Print Shop display all the greeting cards available (sorted by theme or occasion), along with information about how they are folded.

Similarly, when you're selecting a project from the library, the preview thumbnails of Print Artist and PrintHouse are large enough, and they also show you all pages of a multipage project, such as the outside and inside of a card. ColorStore, PrintMaster, and Print Shop display the front and not the inside. Home Publishing's previews are too small, but there is a text display of the inside message.

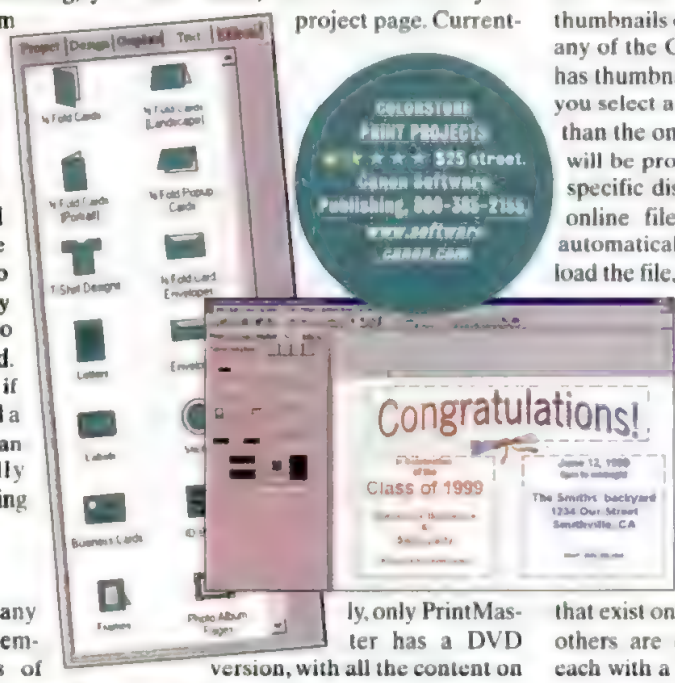


PLANNING YOUR PROJECT

When planning a party, you'll want to have coordinated projects—that is, a banner, party hats, masks, place mats, name tags, and so on—with the same theme as your invitation. Home Publishing, Print Artist, PrintHouse, and Print Shop have specific categories for party sets or business templates (and ColorStore has attractive matching envelopes for greeting cards and invitations). With ColorStore and PrintMaster, you must search among many categories or do extensive copying and pasting of design elements. But even those programs with matching sets rarely have all the kinds of projects you want in the motif you've selected. To help you create your own coordinat-

ILLUSTRATION BY LORA MORGENSTERN

ed sets, Print Shop has a button for adding the currently selected object to your private scrapbook for use later in another project. In Home Publishing, you can save art from the Clip Gallery into personal project folders. And both Home Publishing and PrintHouse allow you to convert any project into another kind. For example, if you've created a poster, you can automatically make a matching flyer.



CONVENIENCE

With the many thousands of templates, pieces of clip art, photos, and so forth that are included in these packages, it should come as no surprise that they span from one (ColorStore) to nine (PrintMaster) CDs. That means you will constantly be shuffling disks in and out of the drive, as you search and place art, greetings, animations, and so forth onto your project page. Currently, only PrintMaster has a DVD version, with all the content on one disk. Some programs smooth the CD shuffle, organizing their libraries intelligently; others seem to have missed the point of thumbnails and databases entirely.

PrintMaster's CD version has a superb database and search engine. You can browse the entire library, viewing thumbnails of files available on any of the CDs. In fact, it even has thumbnails of online art. If you select a file on a CD other than the one you're using, you will be prompted to load that specific disk. If you select an online file, PrintMaster will automatically go online, download the file, and place it in your project, as easily as if it were on your hard disk.

On the opposite end of the convenience scale, PrintHouse's searchable catalog will display thumbnails of only those files that exist on the current CD. All others are displayed as icons, each with a CD number. If you want to view any of those files, you have to load the specified disk.

The other programs display all thumbnails (Home Publishing's installation offers this as an option) and have searchable libraries.

CONTENT

The quality of the content is rather impressive. Gone are the days when clip art did not print attractively. But what you can do with the art once it is in your project depends on the kind of program you are using. This is one of the deciding factors in purchasing this type of software. Do you want top-notch graphics that you can place and leave alone? Or do you like to play with details, customizing the provided art, making it fully your own?

Clip art in Print Shop is unusually artistic; you'd be proud to use the graphics in any personal or professional print project. PrintMaster includes among other things American Greetings content and *National Geographic* photos, and Home Publishing has content and sentiments from Hallmark. But vector art from Home Publishing, PrintMaster, and Print Shop cannot be edited. Print Artist's very nice and varied content is fully

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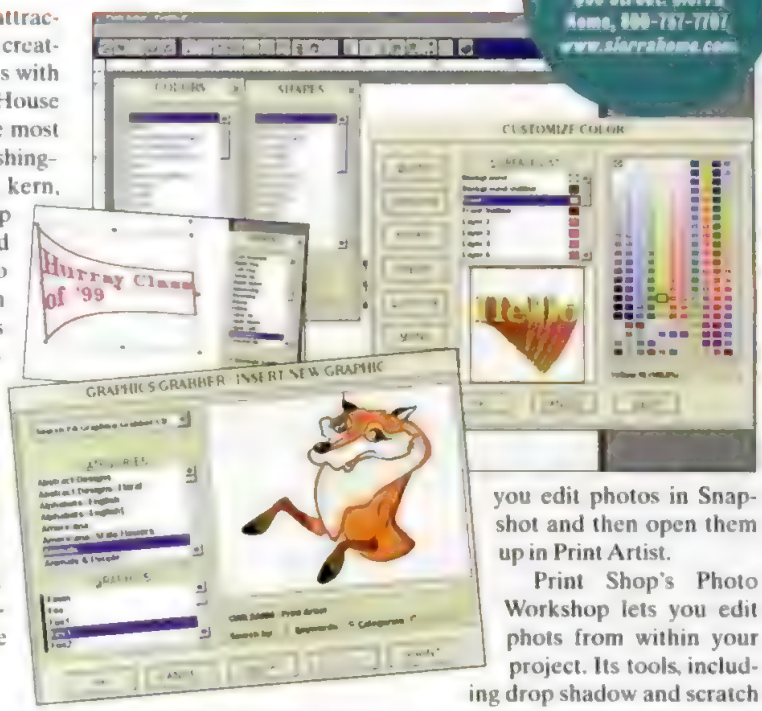
editable, down to the individual curves and colors that make up the vector clip art. ColorStore keeps its bargain price by not competing with the others in content, so its clip art is the least impressive in this group, and none of the vectors are editable (it does have a large number of project types, however).

Home Publishing also features multimedia greeting cards, to which you can add animation clips, sounds, and travel effects for text. It's both easy and fun to use. PrintMaster has animation clips, too, but you can't preview them either in the library or in your project, which makes them next to useless.

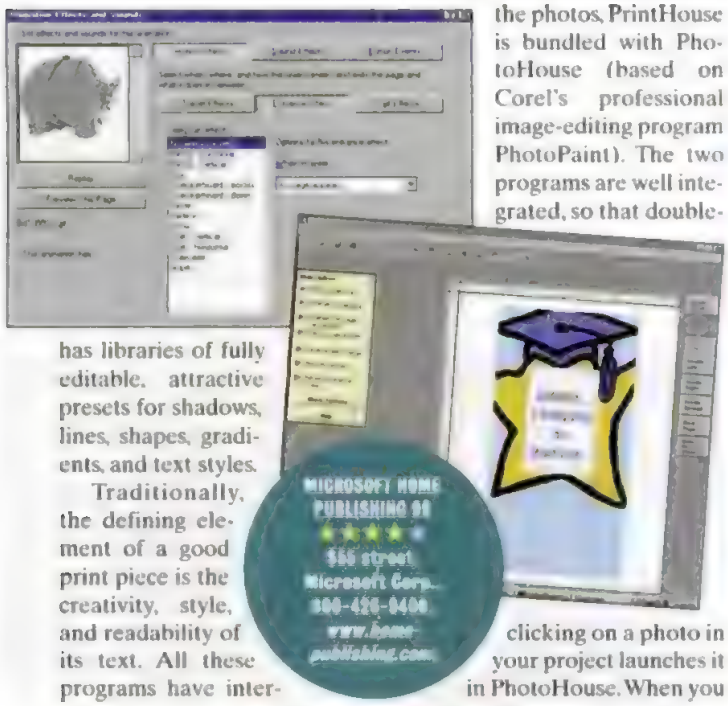
PrintHouse, because it is based on the professional program CorelDraw, has very impressive editing and creative tools. You can break apart vector clip art into components, to change a shape or color or to remove an element. You can fit any picture or text into an editable shape, such as a heart, check mark, or cloud. PrintHouse has libraries of fully editable, attractive presets for shadows, lines, shapes, gradients, and text styles.

Traditionally, the defining element of a good print piece is the creativity, style, and readability of its text. All these programs have interesting text effects, including the ability to mold text blocks into various shapes. ColorStore holds its own against the big guys, offering nice (though not extensive) controls for attractive, artistic text. For those creating newsletters or projects with large blocks of text, PrintHouse and PrintMaster have the most extensive desktop publishing–type tools, letting you kern, adjust line spacing, wrap text around graphics, and so forth. PrintMaster also lets text flow between blocks. PrintHouse has excellent presets for shadows, gradient fills, and shapes (text wrap), as well as powerful custom controls for shadows and gradients. Print Artist and Print Shop excel in providing extensive control for customizing headlines. By contrast, Home Publishing's text tools are somewhat limited.



THE PERSONAL TOUCH

You can place your own photos in these programs, by acquiring them from a scanner, from a digital camera, or from any disk. In case you want to edit the photos, PrintHouse is bundled with PhotoHouse (based on Corel's professional image-editing program PhotoPaint). The two programs are well integrated, so that double-clicking on a photo in your project launches it in PhotoHouse. When you finish editing the photo, clicking on a button updates the image in your project and closes PhotoHouse.



PrintMaster has a similar double-click link to its bundled PhotoEnhancer for editing photos. Print Shop's Photo Workshop is even more fully integrated, because it appears as a pull-down menu within the program. Print Artist ships with Snapshot SE, on which it also depends for its e-mail and Web functionality. But Snapshot is completely separate from Print Artist, requiring that you edit photos in Snapshot and then open them up in Print Artist.

Print Shop's Photo Workshop lets you edit phots from within your project. Its tools, including drop shadow and scratch correction, are excellent—and easy to use. You can also use Photo Workshop's Photo Organizer feature to store your pictures or create albums and slide shows.

When acquiring a photo from a scanner or a digital camera, Home Publishing opens its companion photo program Picture It! Express. After processing, the picture is placed in the

PC MAGAZINE EDITORS' HOT LINKS

www.pcmag.com/hotlinks

➤123Greetings
www.123greetings.com
Whatever the occasion, you'll find an appropriate sentiment at this virtual card shop. Best of all, it's all free.

➤Origami: The Paper's World
www.origami.aanet.ru/origami
Just for fun, this site teaches the story behind the Japanese paper-folding tradition known as origami, and it gives step-by-step instructions on creating your own.

➤paperStudio
www.paperstudio.com
If you want to create professional-looking greeting cards, invitations, or business cards, the paper and designs sold at paperStudio fill the bill.

➤Paper Paradise
www.paperparadise.com
The authority on paper models, Paper Paradise supplies everything from animals to castles—with lots of free samples.

➤Preschool Paper Crafts
www.makingfriends.com/precrafts.htm
Lots of fun for the young ones, this site offers easy-to-follow instructions and projects with titles like Fruit Faces and Paper Pizza.

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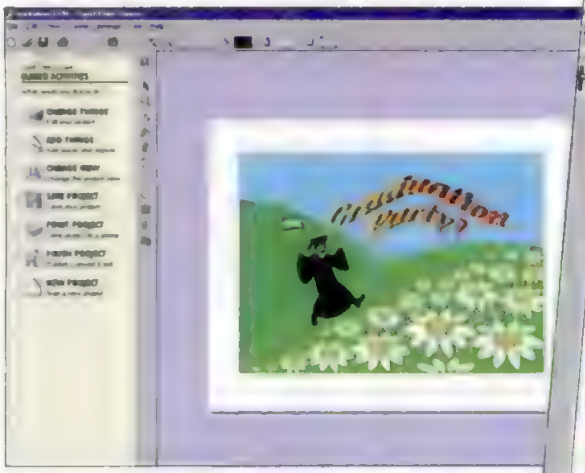
current Home Publishing project. Once a photo is on the page, however, you can't double-click it to reedit it in Picture It! Instead, you have to open the picture up in Picture It!, edit and save it, and move it back into your page.

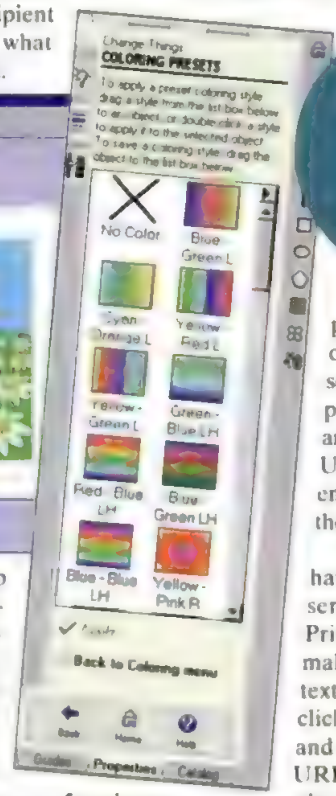


WORKING WITH THE WEB

An increasing number of graphics programs offer additional content via a Web link to their home pages, but not all of these programs have joined the trend. Print Artist's link offers new, free layouts and art monthly, often with a seasonal focus, plus a 60-day free trial membership to Art Today (an Internet clip art and font service). PrintMaster has seamless online integration with free graphics from Art Gallery, but it offers no additional layouts. Print Shop's link provides free art and layout; ColorStore and PrintHouse currently do not offer either. Most of Home Publishing's Web downloads are priced from $2.95 to $4.95 a pack, but there are a few free ones.

All these programs produce impressive printed output, and most also boast some Web functionality. This ranges from almost universal (though uneven) support for e-mailing projects to widely varying offerings for Web page and multimedia creation.

All but Print Artist let you send e-mail from within the program you're using, by attaching a file to your default mail program. (Print Artist's companion photo-editing program, Snapshot, can send e-mail, though.) Just because a program sends e-mail doesn't guarantee that the recipient will receive what you've intended.



Print Shop generates a universally readable JPEG file, but it will send only certain one-page online greetings and not other types of projects (for example, our graduation party invitation). When we looked at the BMP file of our fourfold invitation that ColorStore sent, we were surprised to see a single page exactly like our printed version, which meant that half of it was upside down. PrintHouse offers two options: You can send a series of JPEG files (one for each page of your invitation) or a single file in a proprietary format (which requires that the recipient have PrintHouse to read it). Although any PrintMaster project can be e-mailed, the program sends files in a proprietary format. As an alternative, you can have PrintMaster post your project on Mindscape's server, and the program will send an e-mail with the URL to the recipient, who can view it there.

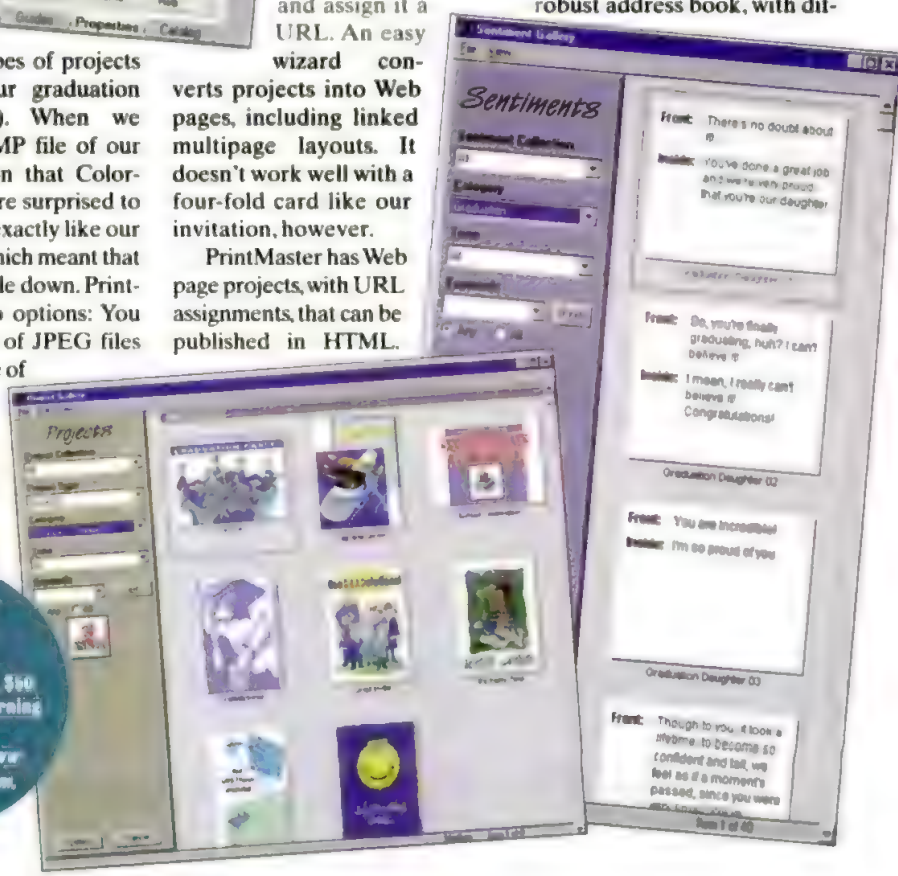
In addition to having an e-mail send command, PrintHouse can make any object, text, or picture into a clickable hotspot and assign it a URL. An easy wizard converts projects into Web pages, including linked multipage layouts. It doesn't work well with a four-fold card like our invitation, however.

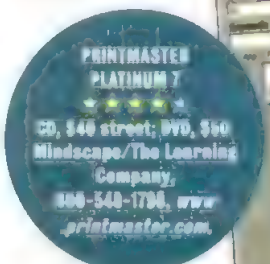
PrintMaster has Web page projects, with URL assignments, that can be published in HTML. None of its other projects can be published to the Web, however. Print Shop's Web Site Designer creates Web pages that can upload to your server or be displayed in your default browser.

Home Publishing's e-mail and Web tools are the best in the bunch. The program automatically converts any project into HTML. You can preview it in your default Web browser before sending it as an attachment via AOL, Microsoft Outlook, or Outlook Express or on a floppy disk. When it's a multipage document such as our invitation, each page is displayed with button links to adjoining pages.

GETTING THE WORD OUT

After creating our graduation party invitation, we wanted to send it to our invited guests using mail-merge. Print Artist is the only program that doesn't have an address book, but it can do mail-merges with lists from Microsoft Word, Excel, or Access. ColorStore has a very robust address book, with dif-





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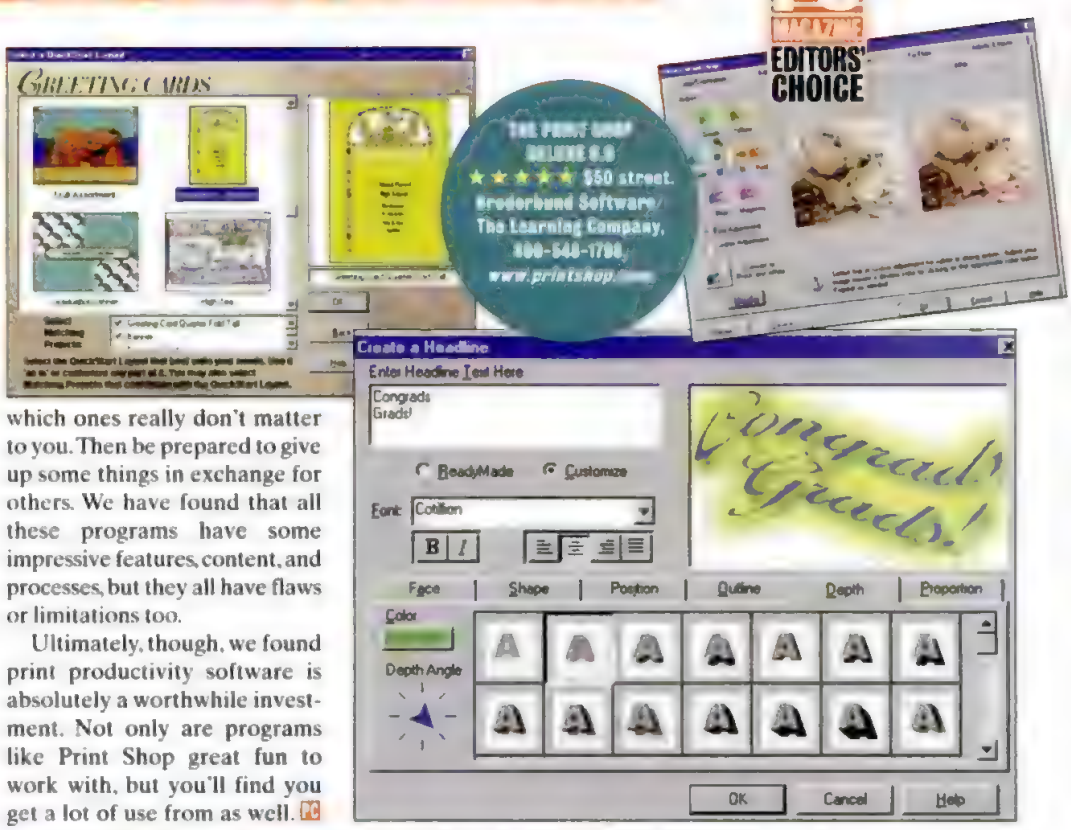
ferent mailing lists, easy mail-merge, and even e-mail–merge. PrintMaster's and Print Shop's address books allow multiple mailing lists (for little Jenny's circle of girlfriends, her mother's business associates, and so forth). In addition, PrintMaster's Event Reminder notifies you of a birthday, anniversary, or other occasion(when you power up Windows).

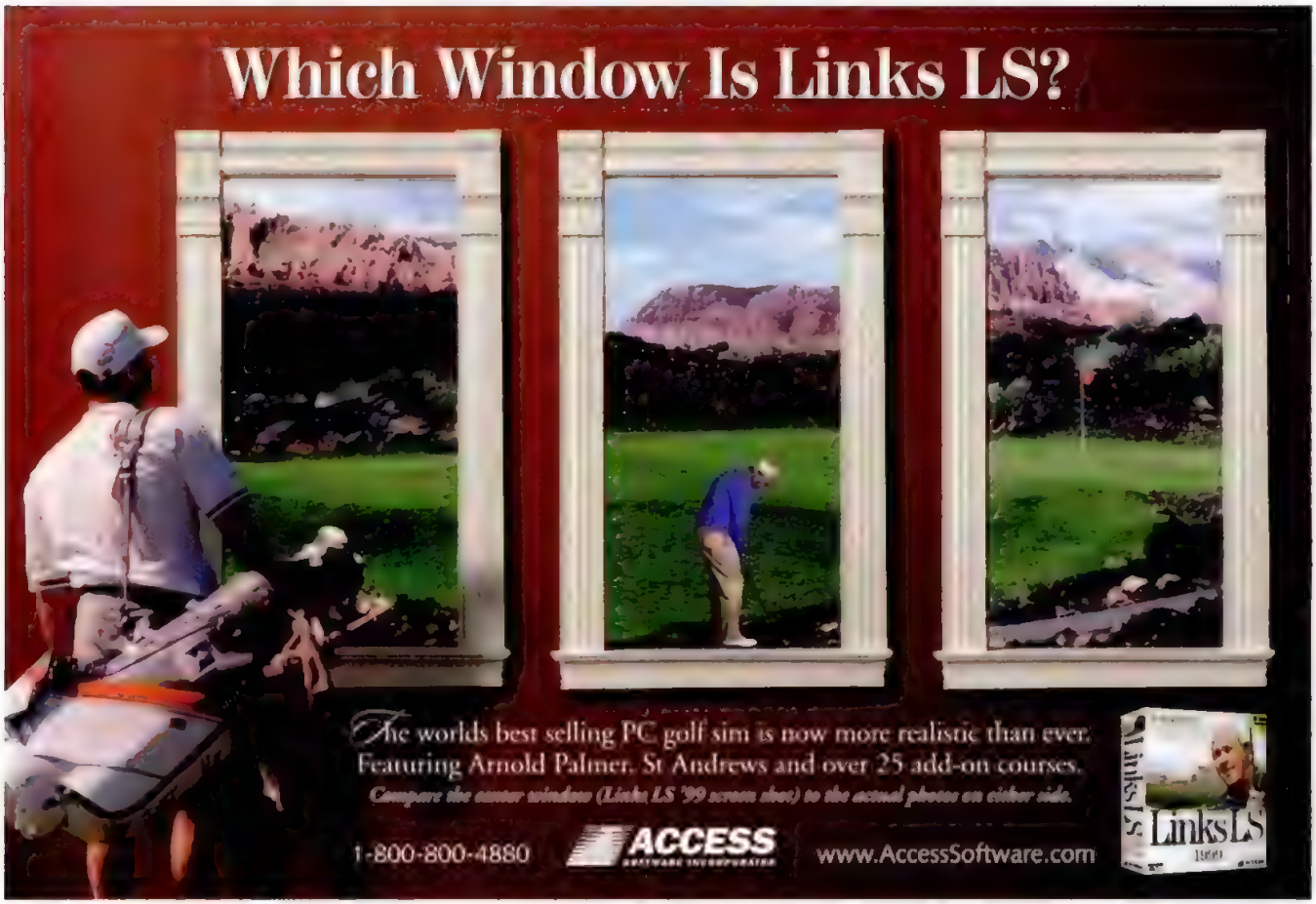
PrintHouse has a separate address book program—Corel Family & Friends—for merging multiple mailing lists and managing a personal calendar. Like PrintMaster, Corel Reminder alerts users about upcoming occasions.

WHICH TO CHOOSE?

With the many small and significant differences among these programs, finding the right one may involve some compromises. Determine which features suit your needs and personality and which ones really don't matter to you. Then be prepared to give up some things in exchange for others. We have found that all these programs have some impressive features, content, and processes, but they all have flaws or limitations too.

Ultimately, though, we found print productivity software is absolutely a worthwhile investment. Not only are programs like Print Shop great fun to work with, but you'll find you get a lot of use from as well.





Coming Up

What's in the Next Issue of *PC Magazine*

Special Report: Create Great Web Sites

Building a great site involves myriad decisions. And this special report will help you make the right call every step of the way. To do this, we'll review a host of popular page-creation tools, along with Web-based (and mostly free) services that can help provide the finishing touches. We'll also take a critical look at Windows NT, Solaris, and Linux and the major Web servers that run on each.

Building a great Web site also means creating an interactive experience for visitors. You need dynamic, database-driven Web pages created on the fly, as well as a scalable base to grow on. To that end, we will review leading tools that can help take your site to the next level.

Network Printers

Whether it's a modest 12-ppm workgroup printer or a 40-ppm monster that can print, copy, and fax for an entire department, there's a network laser printer to fit every need and budget. PC Magazine Labs will test over 25 new models to see which are easiest to set up and administer—and, of course, which are the fastest.

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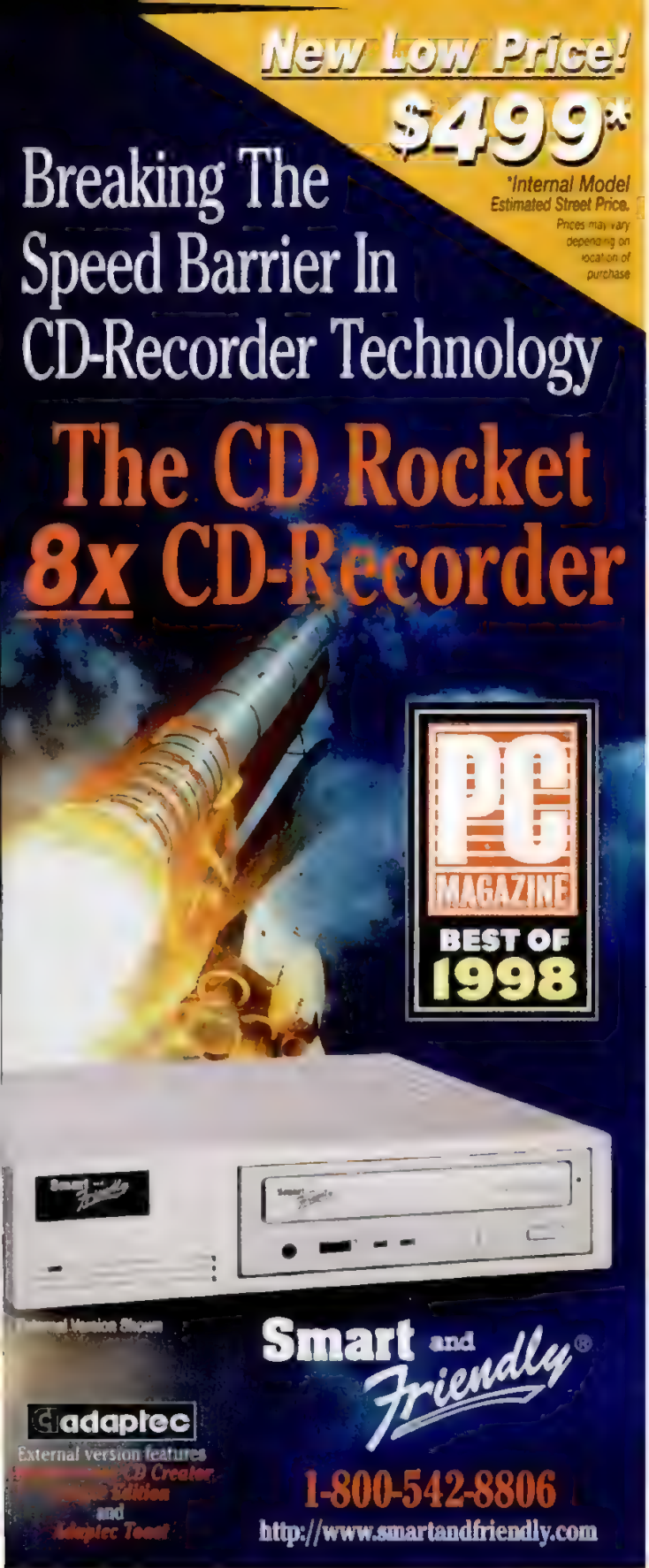

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- ComputAbility
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- Fred Meyer
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- The Good Guys
- Insight Direct
- J&R Computer World
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CPU Type	Speed	Memory	HD	Monitor	Price	Part #
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IBM/Cyrix 6x86	PR366	64MB	8.4GB	17"	$889.99	(CTPTM23)
AMD K6-2	333MHz	96MB	10.2GB	17"	$979.99	(CTPTM26)
AMD K6-2	350MHz	128MB	10.2GB	17"	$1019.99	(CTPTM35)
Intel Pentium II	350MHz	64MB	6.4GB	17"	$999.99	(CTPTM11)
AMD K6-2	450MHz	64MB	6.4GB	15"	$959.99	(CTPTM40)
AMD K6-2	400MHz	128MB	10.2GB	17"	$1099.99	(CTPTM37)
Intel Pentium II	400MHz	96MB	10.2GB	17"	$1139.99	(CTPTM12)
AMD K6-3 w/256K cache	400MHz	128MB	13.0GB	17"	$1229.99	(CTPTM39)
Intel Pentium II	450MHz	64MB	8.4GB	17"	$1269.99	(CTPTM29)
Intel Pentium III	450MHz	128MB	13.0GB	17"	$1489.99	(CTPTM42)
Intel Pentium III	500MHz	128MB	13.0GB	17"	$1749.99	(CTPTM43)

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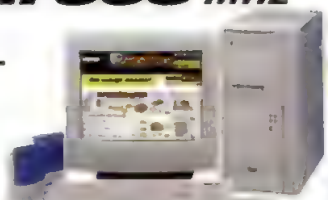

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M-571—AT SOCKET 7 with 4 PCI/3 ISA And PCI Sound & PCI Video with 4MB Onboard

M-598—AT SUPER SOCKET 7 with 3 PCI/2 ISA And PCI Sound & AGP Video with 8MB Onboard

Tiger 573 Form Factor: **AT** • CPU: **Socket 7** • Bus Speed: **Up to 75MHz** • On Board Video: **No** • On Board Audio: **YES** • PCI Slots: **4** • ISA Slots: **2** • Memory: **2DIMM/4SIMM** • Max Memory: **128/256 MB**

Tiger 571 Form Factor: **AT** • CPU: **Socket 7** • Bus Speed: **Up to 83 MHz** • On Board Video: **PCI 4MB** • On Board Audio: **YES** • PCI Slots: **4** • ISA Slots: **3** • Memory: **2DIMM/4SIMM** • Max Memory: **128/256 MB**

Tiger 598 Form Factor: **AT** • CPU: **Super Socket 7** • Bus Speed: **Up to 100MHz** • On Board Video: **AGP 8MB** • On Board Audio: **YES** • PCI Slots: **3** • ISA Slots: **2** • Memory: **3DIMM** • Max Memory: **768 MB**

Tiger 6KE LX, 6BA+ BX Slot 1 With AGP

Motherboard & Case: Motherboard mounted in dual-cooling fan case; 200 Watt p/s, cable & manual.

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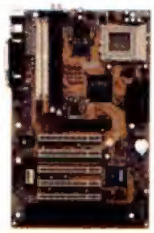
Tiger 6KE LX Form Factor: **ATX** • CPU: **Slot 1** • Bus Speed: **Up to 66 MHz** • PCI Slots: **4** • ISA Slots: **3** • Memory: **3 DIMM Sockets** • Max Memory: **384 MB**

Tiger 6BE+ BX Form Factor: **ATX** • CPU: **Slot 1** • Bus Speed: **Up to 100MHz** • PCI Slots: **4** • ISA Slots: **3** • Memory: **3 DIMM Sockets** • Max Memory: **768 MB**

Tiger SS7 ATX Super Socket 7

Motherboard & Case: Motherboard mounted in ATX case with 1MB Cache ; 235-watt p/s, cables, manual

Pre-Assembled Kits: Motherboard in dual-cooling fan case; keyboard, speakers, mouse, 3D AGP video, 56K modem, 1.44MB floppy drive, 24X CD-ROM, Wave Table sound.

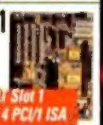


Tiger SS7 Motherboard Features At-A-Glance

Form Factor: **ATX** • CPU: **Socket 7** • Bus Speed: **Up to 100 MHz** • AGP Slots: **1** • PCI Slots: **5** • ISA Slots: **2** • Memory: **3DIMM Sockets** • Max Memory: **768MB**

Tiger 767 AT, 760 ATX Slot 1

Motherboard & Case: Motherboard mounted in dual-cooling fan case; cables & manual



AT Slot 1 with 4 PCI/1 ISA

Pre-Assembled Kits: Motherboard in dual-cooling fan case; keyboard, speakers, mouse,3D AGP video, 56KFlex faxmodem, 1.44MB floppy, 24X CD-ROM, Wave Table sound.

Micro ATX Slot 1 with 3 PCI/1 ISA

Tiger 767 Form Factor: **AT** • CPU: **Slot 1** • Bus Speed: **Up to 100 MHz** • On Board Video: **8MB AGP** • On Board Audio: **YES** • PCI Slots: **4** • ISA Slots: **1** • Memory: **DIMM** • Max Memory: **768 MB**

Tiger 760 Form Factor: **Micro AT X** • CPU: **Slot 1** • Bus Speed: **Up to 100MHz** • On Board Video: **8MB AGP** • On Board Audio: **YES** • PCI Slots: **3** • ISA Slots: **1** • Memory: **DIMM** • Max Memory: **768 MB**

MOTHERBOARD SPECIFICATIONS

Motherboard Design	Processors Supported	MOTHERBOARD ONLY Item No.	1-2 units	3+ units	MOTHERBOARD & CASE Item No.	1-2 units	3+ units	PRE-ASSEMBLED KITS Item No.	1-2 units	3+ units
Tiger 571 AT including Wave Table sound and PCI video	**AMD** Up to K6-300 & K62-266 **Intel** Pentium up to 233 MMX **IBM/Cyrix** Up to PR300	MB1-C-1B	$75.99	$69.99	BB1-C-1B Mid-tower AT case with 200-Watt power supply	$127.99	$119.99	KT1-C-1B See above for Kit components	$209.99	$195.99
Tiger 573 AT including Wave Table sound	**AMD** Up to K6-300 **IBM/Cyrix** Up to PR300; **Intel** Pentium up to 233 MMX	MB1-E-8A	$49.99	$44.99	BB1-E-8A Mid-tower AT case with 200-Watt power supply	$94.99	$89.99	KT1-E-8A See above for Kit components	$164.99	$157.99
Tiger 598 AT including 1MB Cache, Wave Table sound and PCI video	**AMD** Up to K6-3/450 **Intel** Pentium up to 233 MMX **IBM/Cyrix** Up to PR366	MB1-E-11A	$82.99	$77.99	BB1-E-11A Mid-tower AT case with 200-Watt power supply	$139.99	$129.99	KT1-E-11A See above for Kit components	$234.99	$216.99
Tiger SS7 Super Socket 7 1MB Cache	All **AMD** Up to K62-450; **Intel** Pentium up to 233 MMX **IBM/Cyrix** up to MII 366	MB1-T-7B	$74.99	$69.99	BB1-C-2D Unassembled—ATX case with 235-Watt power supply & Free Floppy Drive	$149.99	$137.99	KT1-E-2C See above for Kit components	$279.99	$264.99
Tiger 767 AT Slot 1 with Sound & AGP video	**Celeron** up to 433MHz **Intel** Pentium II up to 500MHz	MB1-E-5A	$97.99	$91.99	BB1-E-5A AT Case 200 W Power Supply	$154.99	$144.99	KT1-E-5B See above for Kit components	$239.99	$229.99
Tiger 760 Micro-ATX Slot 1 w/Sound & AGP video	**Celeron** up to 433MHz **Intel** Pentium II up to 500MHz	MB1-E-6A	$96.99	$91.99	BB1-E-6A Micro ATX Case 140W Supply	$139.99	$129.99	KT1-E-6A See above for Kit components	$234.99	$222.99
Tiger 6KE LX ATX Slot 1	**Celeron** up to 433MHz **Intel** Pentium II up to 333MHz	MB1-T-10A	$42.99	$39.99	BB1-T-10A Unassembled—ATX case with 235-Watt power supply & Free Floppy Drive	$109.99	$103.99	Not Available		
Tiger 6BA+ BX ATX Slot 1	**Celeron** up to 433MHz **Intel** Pentium II up to 500MHz	MB1-T-9B	$84.99	$79.99	BB1-T-9A Unassembled—ATX case with 235-Watt power supply & Free Floppy Drive	$149.99	$139.99	KT1-M-7A See above for Kit components	$369.99	$354.99

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#CP2-K62-350	350	3DNow!	$84.99	$79.99*
#CP2-K62-400	400	3DNow!	$124.99	$121.99*
#CP2-K62-450	450	3DNow!	$177.99	$169.99*
#CP2-K63-400	400	w/256k Cache	$287.99	$274.99*

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Tiger recommends the AT motherboard or the Tiger Super Socket 7 motherboard with these processors.

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#CP2-6X333	MII 333 CPU	$53.99	$51.99*
#CP2-6X366	MII 366 CPU	$69.99	$66.99

Intel Celeron, Pentium II & III

*** Celeron CPUs are socket 370 format and require a fan and adapter (C183-1000) to be used in any slot 1 motherboard.

Intel Celeron, Pentium II & III Processors		1-2 Units	3 units or more
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#CP1-CI366	Intel Celeron **366** processor***	$82.99	$78.99
#CP1-CI400	Intel Celeron **400** processor***	$116.99	$111.99
#CP2-P2-350	Intel Pentium II **350** processor	$186.99	$179.99
#CP2-P2-400	Intel Pentium II **400** processor	$268.99	$261.99
#CP2-P2-450	Intel Pentium II **450** processor	$449.99	$438.99
#CP2-P3-450	Intel Pentium III **450** processor	$469.99	$454.99
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The Tiger AT, ATX, and ATX Server Cases all include a mid-tower, dual-cooling fan design.

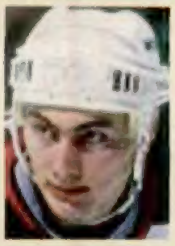
Item #	Description	1-2 Units	3+ Units
CA1-C-1A	AT Case 5-Bay 200-Watt P/S	$44.99	$41.99
CA1-C-2A	ATX Case 6-Bay 235-Watt P/S	$58.99	$55.99
CA1-M-5A	ATX Server 6-Bay 300-Watt P/S	$124.99	$119.99

abort. retry. fail?

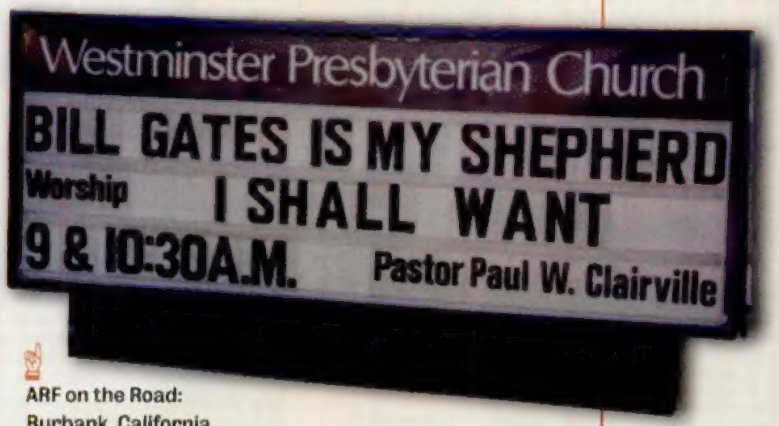
THE LIGHTER SIDE OF PERSONAL COMPUTING

Edited by Don Willmott

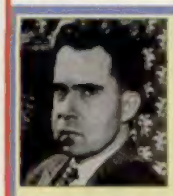
A Satanic Coincidence?



Eagle-eyed reader Timothy Kjaer was browsing through hockey stats on ESPN.com and checking on the record of Buffalo Sabres' left wing Miroslav Satan. Then he noticed something exceedingly strange. Guess what the URL of Satan's stat page is? *espn.go.com/nhl/profiles/profile/0666.html.*



ARF on the Road: Burbank, California.

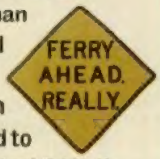


Richard Milhous Nixon
U.S. Army General

Born on January 9, 1913, in Yorba Linda, California, into a lower-middle-class Quaker family, Richard Nixon had a difficult childhood. In school he was an ambitious student, but not one who excelled. Upon graduation, he entered Whittier College. Nixon

Nixon an army general? Interesting concept, but it never happened. (CNN Interactive.)

The Wet Mercedes Chronicles



The Associated Press reports: "A German couple out for a Christmas drive ended up in a river—apparently because their luxury car's computer navigation system forgot to mention that they had to wait for a ferry. The driver kept going straight in the dark, expecting a bridge, and ended up in the water."

The Y2K marketing onslaught has begun! (Novack's Outdoor Store ad.)

Mini Candle Lantern
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Canada Braces for Y2K Crisis

Canada seems to be taking Y2K in stride. *The Vancouver Sun* recently asked a prominent local banker about the potential crisis. The response: "Mr. Morreau said Canadian banks are world leaders in computer bug preparations and discourages stuffing funds under one's mattress."

If your entry is used, we'll send you $50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, 28 E.28th St., New York, NY 10016-7930 or via e-mail to *don_willmott@zd.com*. Winners this issue: Linda Ferrington, Arthur Fisk, Mike Jutan, Timothy Kjaer, Chris Mannhardt, and Duane Schmidt.

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